

ABOKE

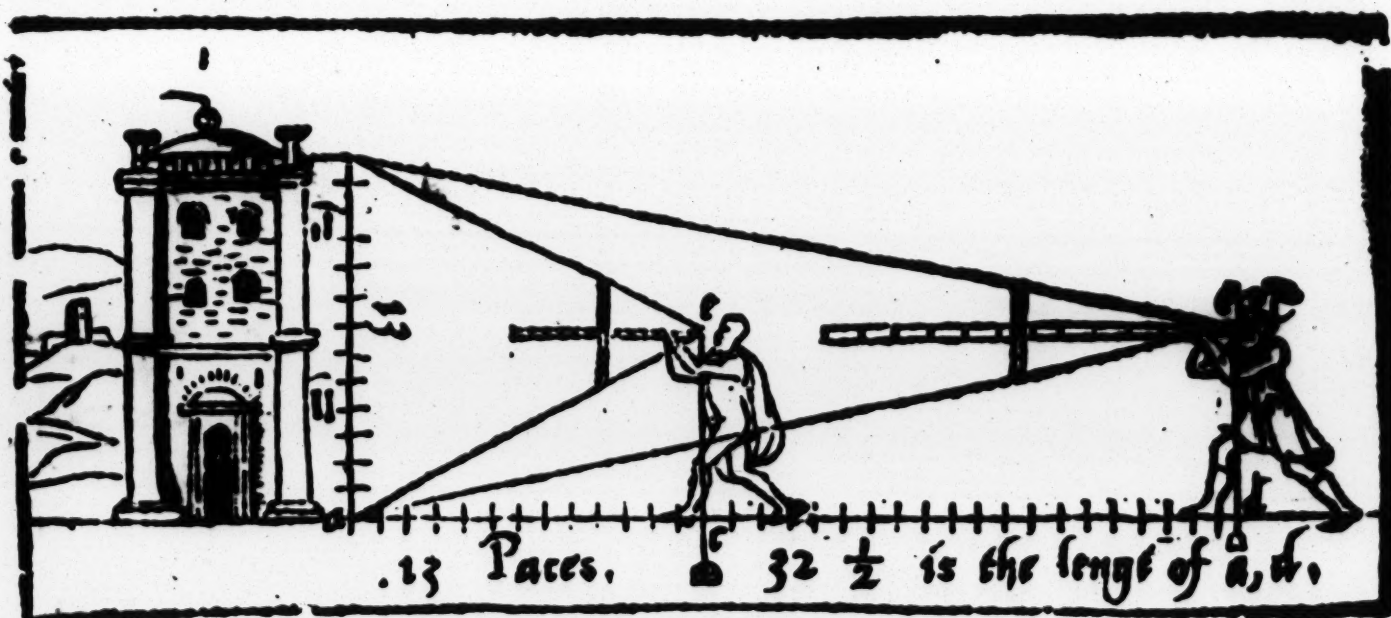
page 2
C. 7. c. 8.

Named Tectonicon.

Briefly shewing the exacte measuringe, and
speedy reconinge all maner of Land, Squares, Timber, Stone,
Steeple, Pillers, Globes. &c. Further, declaring the per-
fect making and large vse of the Carpenters Ruler, contay-
ning a Quadrante Geometrical, comprehendinge also
the rare vse of the Squire. And in th'ende a little treatise
adioyned, opening the composition and appliancy of an
Instrument called the profitable Staffe, with other
things pleasant and necessary, most conducing
for Surveyours, Landmenters,
Joyners, Carpenters,
and Masons.

Published by Leonard Digges Gentleman
in the yeare of our Lorde.
1556.

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L. D. to the Reader.



Although (gentle Reader) manye excellent in Geometrye, vpon infallible groundes haue put forth diuerse most certayne and sufficient rules, touching the measuring of all manner Superfici- cis: yet in that the Arte of numbring bath beene required, yea chieflye those Rules hid, and as it were locked vp in straunge tongues (they do profite) or haue furthered very little the most part: certes nothing at all, the Landmeater, Carpenter, Mason, waiting the aforesayd, for their sakes I am here prouoked not to hide, but to open, and so encrease the talent which I haue receyued, yea, to publishe in this our tongue verie shortly (if God giue life) a volume containing the flowers of the Sciences Mathematicall, largely applyed to our outward practise, profitably pleasaunt to all maner men of this Realme. In the meane time I shall desire the Artificers aboue named, to bee contented with this little Booke (a taste of my good will towarde them) which I wish euen so to further the readers, as I know it sufficient for the true measuringe and ready accompte of all manner Lande, Timber, Stone, Boorde, Glasse, Pavement. &c.

Here myne aduise shall be to these Artificers that wil profite in this, or any of my bookes, now published, or that hereafter shalbe, first confusely to reade them throughe, then with more iudgemēt. Read at y^e thirde reading wittely to practise. So few thinges shalbe vnknewen. Note, oft diligent reading, ioyned with ingenious practise, causeth profitable labour.

Thus most hartely farewell (louinge Reader) to whom I wishe my selfe present to further thy desire and practise in these,
The

**The pleasaunte profite or content of
this little booke, and in what it exceedeth
all other published.**



Ther bookes tofore put forth in our English tongue
contayned only the bare measuring of Land, Tim-
ber and Boorde, howe agreeable in all places to the
Rules of Geometrie, let the learned iudge. Heere
(gentle Reader) thou shalt plainly perceiue through
diligent Readinge, how to measure truly and very
speedely all maner Lande, Timber, Stone, Steples,
Pillers, Globes, Boorde, Glasse, Panement. &c. without any trouble,
not payned wyth many rules, or obscure termes. Nor yet wyth the
multitude of Tables, as heretofore hath beene: in which not a few
errors were committed: for that cause no iust account might any
way be had. Further yee shall by this Booke vnderstande the whole
making and comly handeling of the Carpenters Ruler, wyth the true
measure. &c. And his vse appoynted to the ready measuringe of all
kinde of Timber, Stone, Boorde. &c. Also the leueling of groundes,
taking of Heightes, is pleasantly and diuersly practised by the ruler.
Yee haue here not the commo but the rare vse of the Squire applied to
Heightes, Lengthes. &c. and to the findinge of the iust houre of the
day diuers wayes: through the ayde of pleasant Tables, newely ad-
ioyned to my generall Prognostication, by the whych the proporti-
on of thinges directe or Squirewise standinge, are by their shadowes
known.

To conclude, in the ende of this booke is added a treatise shewing
the making and vse of an Instrument, by which yee shall get
lengthes, Heightes, Breadthes, Widneses, where or how
soeuer they stand. Other necessary things are con-
tayned in this little volume, which I commit
to the dilligent Reader.

DIVERS THINGS Fol: 1.

conducible, to the Arte
of measuring.

The first Chapter.



S there are fewe craftsmen, ^{Characters} ^{numeraill.} which haue all the kindes of Arithmetike ready: so I do suppose none so ignorant, but that they be as may easily perceiue the simple significations of these Characters or figures . 1. 2. 3. 4. 5. 6. 7. 8 9. 0. and also their strength in the first, seconde, and thirde runnes places.

Belieue that, they must bee familiar with these and such like fractions.

$\frac{1}{2}$ $\frac{1}{3}$ $\frac{1}{7}$ $\frac{1}{16}$ $\frac{1}{32}$ $\frac{3}{4}$ $\frac{4}{5}$ $\frac{9}{10}$ The first leftmost betwene one second part ^{Fractions} of an whole, be it Pearch, Inche, or any other measure: the next, one thirde, then one seventh part: the other ensuing, one sixteenth. So one thirty and two partes of an Inche. Then followe thre fourthes: four fifthes. The last is nine tenthes of an Inche: that is nine partes of an Inche, deuised into ten portions.

These I do intende to put in my ensamples, and in my Tables, and margines followinge, to represent partes of Pearches or Inches. As if I would write halfe an Inche, after this maner. $\frac{1}{2}$. Thre quarters of an Inche, thus $\frac{3}{4}$. One eight of a Pearch, on this wise. $\frac{1}{8}$. So of the rest.

It is requisite also here to open what a Pearche, a Day worke, a Roode, and an Acre is.

Although there are diuerse Opinions engendred through long custome in many places, of the length of a Pearche (vpon which our chiefe matter dependeth) yet there is but one true Pearche by Statute appointed to measure by. Wherin is ordeined. 3. Barly cornes by and rounde to make an Inch, 12. Inches a Foote. 3. Foote a Parde. 5. Pardes and $\frac{1}{2}$. a Pearche: 40. Pearches in length, and. 4. in breadth, an Acre.

So an Acre by Statute ought to contayne. 160. Pearches: $\frac{1}{2}$ halfe Acre. 80. Pearches, a Roode commonly called a quarter. 40. Pearches, a day worke. 4. Pearches. I.e. here the Acre expressed with his length, and breadth.

B. I must

Breadth.	1	160	Length.
	2	80.	
	4	40.	
	5	32.	
	8	20	
	10	16.	

The Arte of

Instrumente
to measure
with Poales,
Cord knot.
ted.
Profitable
Gaffe.

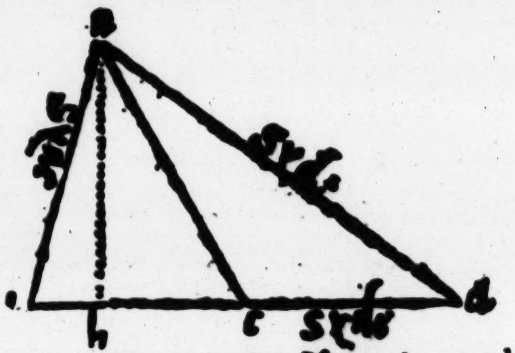
I must not omit here to tell you what thing is meetest to measure lande with. They be commonly in the country two poales, either of them the length of a Pearch. They are very good. Yet for all kinde of landes, as for .j. Peaches in length, well farr with rope and rosin, knotted or marked at the ends of every Pearch, is more meete and con- sider. But for our fantasy, the Instrument Geometrical, which is put forth in the end of this booke putteth them al together, for the great truth and quickest speede. This Instrument is so generall and adaptable to so many things, that it alone requirerh a large booke, if it should be sufficiently described.

Triangle.

Also I would not have you ignorant what peece of lande is called a Triangle, which often shall hereafter be named. It is such a fashioned peece as hath, (as is imagined to have) .j.

Line falling
squarewise.

Angles each: whether the sides be equal or otherwise, as this figure sheweth. Againe, note that a lyne is, saye to fall squarewise, when it cutteth any thinge, or any lyne of a Triangle full crosse. Thus becom a square: As the hang- inge pyched line a.b. in c. d. the base line of the Triangle. Let it cutteth the lyne squarewise, or full crosse in the point b. and not as the other line a.c. doth. The Base of any Triangle is here called that lyne, which is cut squarewise of the hanging lyne.

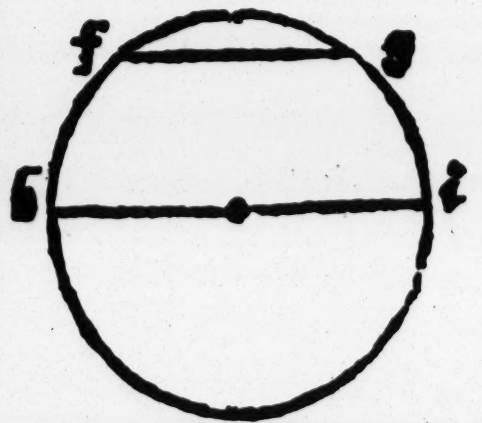


Base line.

Concerning a Circle, knowe that the compasse of any Circle is named a circumference: the middle pointe in him his Centre: the right lyne h. i. that goeth overthwart that Centre touching the circumference on both sides, is his Diameter: the halfe of that lyne, is the Semidiameter. Also an Arche is a peece of the circumference cut away, as yee see the Arche above the lyne f. g. Also f. g. and h. i. in this Circle are named Parallels: for that they differ equally in all places, the one from the other.

Circle.
Circumfe-
rence.
Centre.
Diameter.
Semidiamete-
re.
Arche.
Parallels.

Note because practise, and experience sheweth mee, that there is al- most no lande, but it may easily be brought by imagination to a Tri- angle or Triangles, and so more truly measured: therefore to bee shorte, this word shall be taken. I wyll firste figure and let aske your eyes Triangles Lande, & other which by imagination shall be brought into



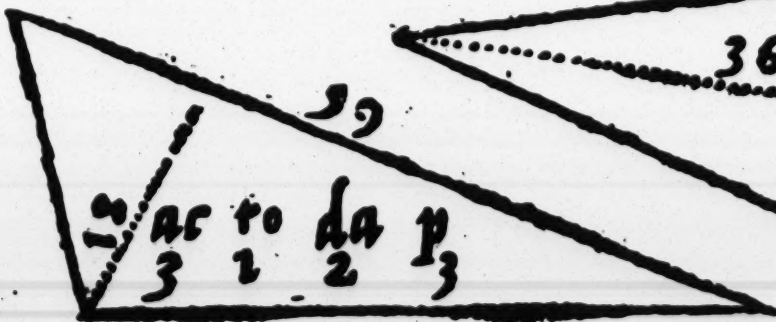
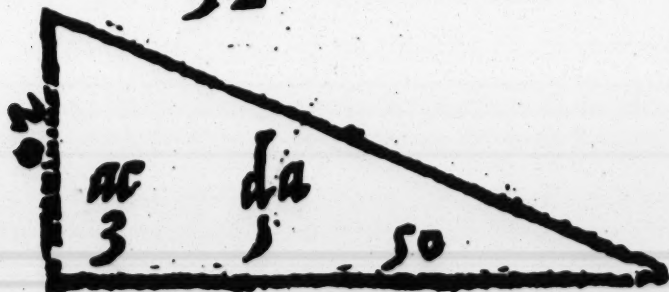
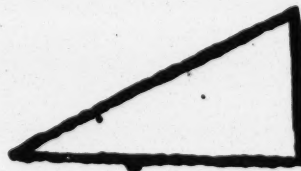
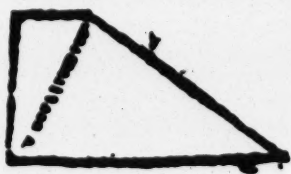
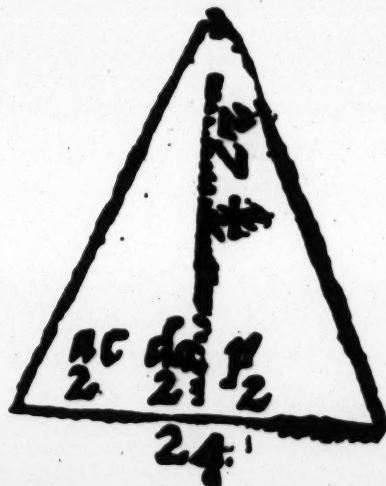
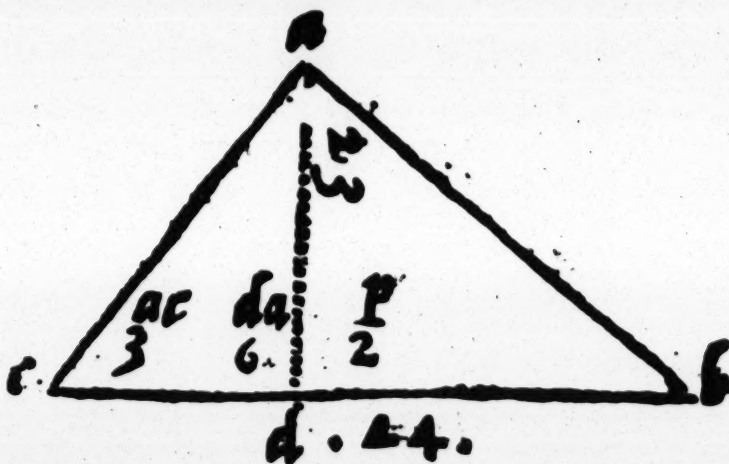
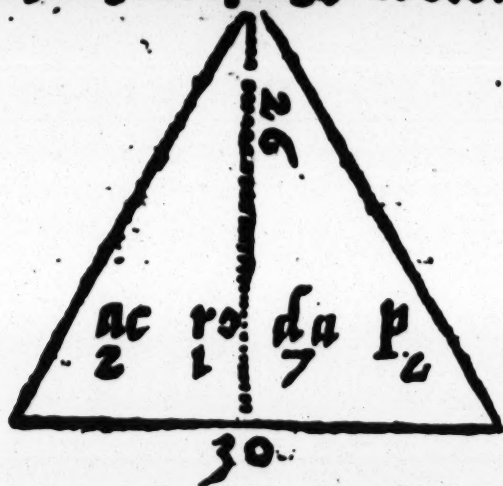
into Triangles: Then I shall teache the true measuringe of the same: I meane howe to finde a length and breadth, w^{ch} which you shal enter the Table of accompt followinge, where the Acres and other Measures (if there be any shal appeare.) As these figures are measured, in all cringles lanne, and other brought into Triangles, of what shape soeuer they be. shal be measured. And because it is requisite for true measuringe of all Triangles, to finde a straight hanginge line, I shall shew first howe that Line is to be founde, imagined, or written.

How the right hanginge line in Triangles is drawn.

The ij. Chapter.

This straight hanginge line in all Triangles, is ever written or imagined from any Angle, cuttinge some one side of that Triangle squarewise: as you may perceiue the pitched lines in the Triangles followinge. By the helpe of this line, all lannes of Triangle shape, are brought to bee measured as ensueth.

To drawe a
hanging or
plumb line.



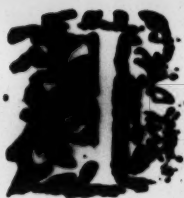
B ij

How

The Arte of How to measure all maner Triangled Lande.

The iij. Chapter.

Euclide the
first booke
41. Pro.



If thou be an Arithmetrician, multiply this straight hanging
lyne, drawn as above is shewed, in halfe þ number of Pear-
ches of that side which it cutteth squrewise. For wante of þ
knowledge, take the aforesaiden Pearches (I meane of the
hanging line, and halfe the side which he cutteth) and with that length
and breadth enter your Table of accompt, as there is set forth. So shall
yee perceiue the number of Acres, Roodes, Day woxkes. &c.

Ensample.

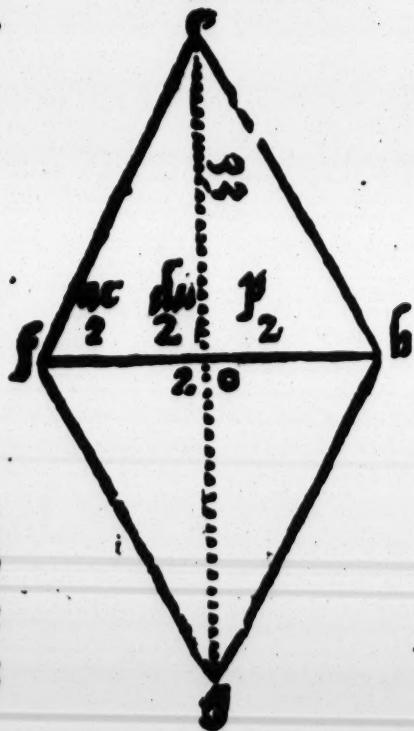
For the perfect measuring of Triangles alope figured, and al other,
suppose the second of these last. 9. figures on the other side, having wryt-
ten about it a b c d to be a peece of land whereof I would haue the true
measure. I finde by a Cordes or otherwise, the pyched hanging line a d
to be. 23 Pearches: the side b c which it cutteth squrewise. 44. Pear-
ches, whose halfe is 22. With these 22. and 23. the convenient length &
breadth, I enter the table of accompt. There I finde by that Table at
the corner where both the lines of convenient length and breadth doe
meete. 3. Acres. 6. day woxkes, and 2. Pearches to be in that Triangle.
Thus of all befoze figured.

This Table
followeth.

Here note your Table must euer be entred with all the Pearches of
the hanging Line, and with halfe the side that he cutteth squrewise.
D; to the halfe hanging line, & the whole side cut.

A figure of a double Triangle.

This figure e. f. g. h. is but two Triangles:
therefore measured as above in two par-
tes: D; thus. The hanging lyne, e. g. is 33.
Pearches: the side f. h. that hee cutteth squre-
wise. 20. Pearches, the halfe of the which is 10.
Now enter your Table as alope, with. 33. & 10. þ
convenient length and breadth. So shall yee finde
2. Acres. 2. Day woxkes, and 2. Pearches, the
true content of this figure. e. f. g. h.



measuring Lande.

An other ensample.

Fol. 3.

A Dmitten i. k. l. m. lande to be measured. Because it is no maner Triangle, it must be brought by imagination, as I have sayd in- to 2 triangle of triangles. Whych imagination is better signi-

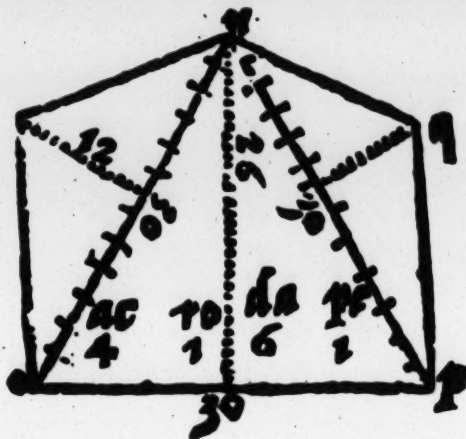
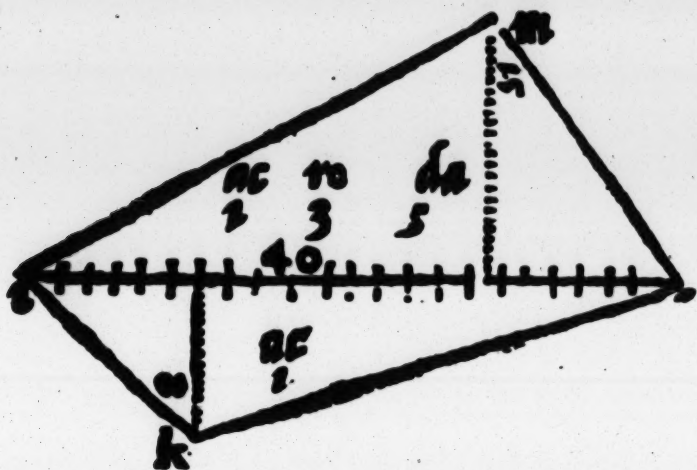


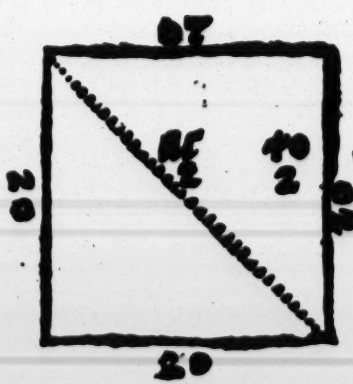
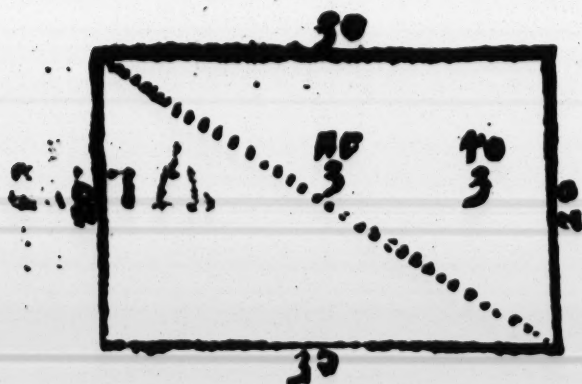
Figure of many Angles.

ficd by the line dashed. i. l. Then as above is declared, it ought to be measured (according to the rule of Triangles) in two partes, because there are two triangles in that lande. So by paces per that lande in the upper i. m. l. one Acre. 3. Roodes & 5. Daymoxes: in the other. i. k. l. one Acre. Thus I gather the whole contents of that lande to be. 2. Acres. 3. Roodes, and. 5. Daymoxes.

None otherwile of the assigned n. o. p. q. and all other figures following: and other whatsoever they are, that by any meanes may be brought into triangles.

Furthermore know that the figure i. k. l. m. is readely thus measured. Adde the Peaches of both the hanginge lynes together: so haue per. 23. With this number, and with halfe the Peaches of the side i. l. which be cutteth squierwile, beinge. 10. Peaches, enter your Table: so is founde as afoze.

These two figures following may also be thus measured, otherwile then by the rule of Triangles. Enter your table with their conuenient length and breadth. So shall you finde the contents of all such.

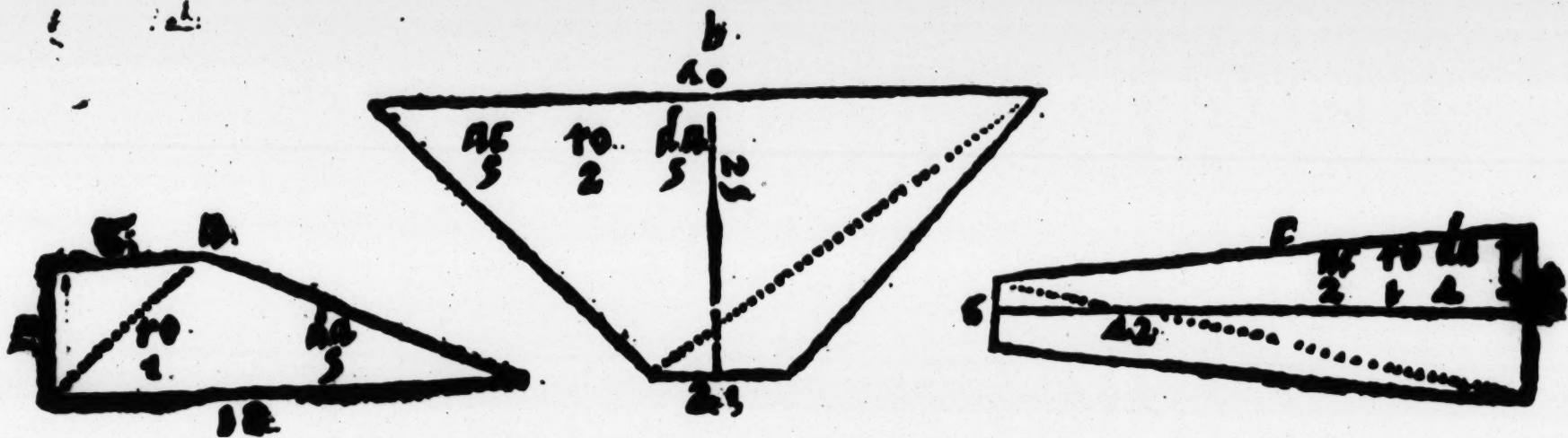


These

The Arte of

These three figures following, although they may be measured by the rule of Triangles, yet for quicker speede, they have also theyr proper measuring as ensueth.

Lay together the two sides which are parallels of the first figure a. that is 6. and 12. making 18. the halfe is 9. the breadth 12. Enter with 9 and 12. your Table. You have per one roode, and five daymes. For the other two b. c. and fetch like, layne the beades of rodes in one: and enter your Table with halfe of these searches, and with 1 whole number of the middle line,



How by supputation to measure all Triangled Lande.

To measure [Draw all the sides together: take halfe: oute of that halfe, pull every line, noting the difference. Then multiply the differences the one triangled land in the other, and the thirde difference augmente in the product. That which encreaseth multiply in the halfe of all the sides layned. Then the Root of the surmountinge summe is the content of that Triangle.]

These rules
following.

There are four Rules to be treated of. The first for all manner regular square superficies. The seconde for rounde lande, and his parts. The thirde for Sturples, Columns, Globes, and theyr parts. The last for Mountaynes and Vallies. Where they shall in order follow.

A rule

A rule for all maner regular or righte squared lande of many fydes, as 5. 6. 7.

8. 9. 10. 12. 100. &c.

The iij. Chapter.

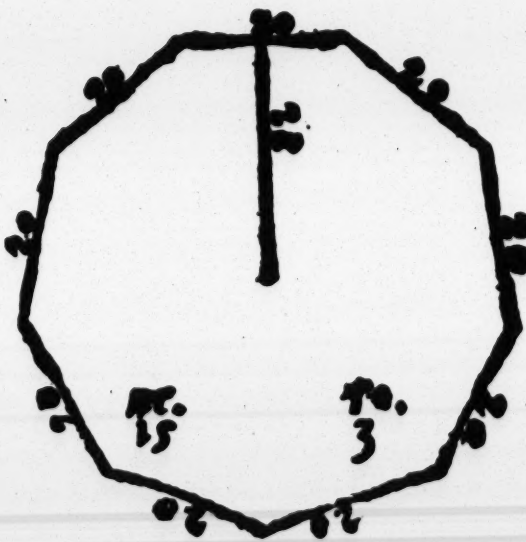
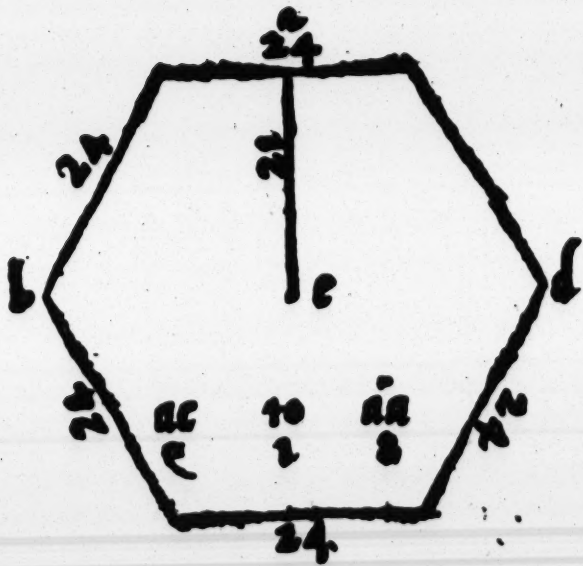
M easure and lay all the fydes together, taking the halfe number of Perches there contayned. Then drawe a right hanging line from the centre or middell of that figure, to the middell of some one fyde. And with that length and the other, enter your Table. Note that the Triangle of all fydes lyke, and the Quadrate figure are also measured by this rule,

To measure land of many fydes.

Ensample.

Suppose this figure a. b. c. d. to be a sixsquare peece of Lande, and every fyde. 24. Perches. The halfe summe of all fydes is. 72. Perches: the right hanginge pyked line a. c. 31. Perches. With these two numbers you must enter your Table of accompt followinge hereafter. And so as is opened in the declaration there adioyned, when numbers surmount the Table as they doe here.

So shall you finde 9. Acres. 1. Rood, and 8. Daymaphes, the content of this figure a. b. c. d. Even thus is the other nine squared figures measured, and latched like.



A rule

The Arte of

The v. Chapter.

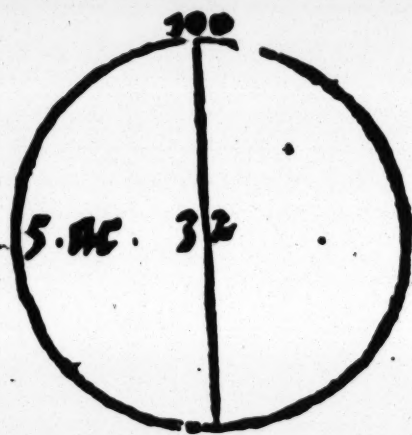
Archimedes in libello circuli mensurationis.

H Also the Diameter multiplied in halfe the Circumference the-
wech the content of any Circle.

2 Or thus more plainly. See that enter your Table with halfe the number of Stitches of the whole Circumference of compass, & with the number of halfe the Diametre of breadth. We have you the content.

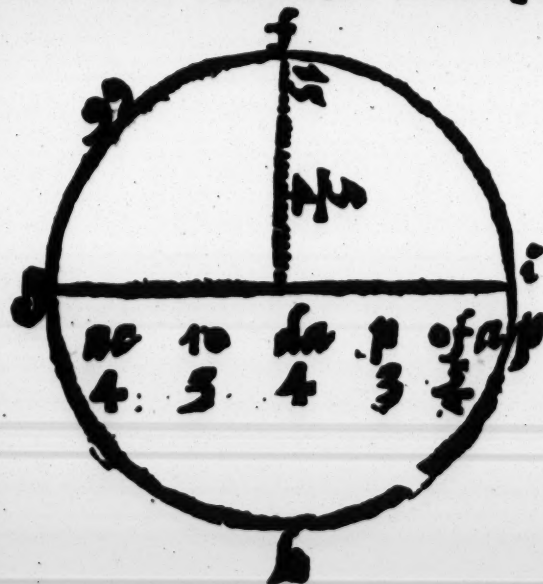
Example.

Suppose a peece of land, whereof the compasse is 100. Perches, the breadth. 33. Perches. I would know how much land is in this figure. Enter your Table with halfe the compasse, that is. 50. and with halfe the breadth, that is. 16. Perches. Because in the Table I cannot finde. 50. for $\frac{p}{2}$ greatest length is. 40. (therefore I enter with 40.) and. 16. And is founde foure Acres. Then I enter again with. 16. Perches remaininge, and. 16. the breadth as before: that bringeth one Acre. Now to conclude, by addition of. 1. and 4. I finde. 5. Acres in that round land, whose halfe compasse is. 50. Perches, & the breadth. 16. Perches.



How partes of pearches are to bee compted in measuring. **F**or perfect knowledge and vse of this Table followinge, when partes of Pearches are adioyned, note well this other ensample that ensueth, and also what is sayde of the declaration annexed vnto the Table, when partes of Pearches are in the length, breadth, or both.

Imagine f. g. h. to bee a rounde peece
of lande: I finde by measure the woble
compasse. 99. Pearches. The halfe is
49. $\frac{1}{2}$. The hanginge Lynce of halfe
breadth is. 15. $\frac{1}{4}$. Enter your table with
the woble Pearches, that is. 49. and
25. leauinge out. $\frac{1}{2}$. and. $\frac{1}{4}$. which were

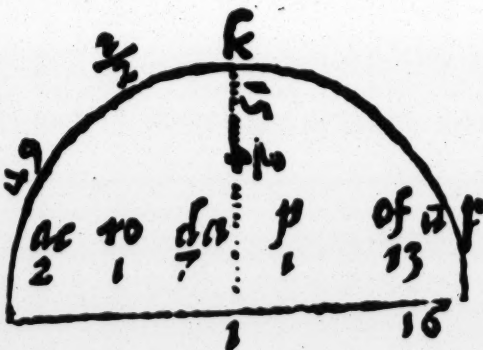


but

but partes of *Pearches*. So haue ye 4. Acres. 2. Rodes, 3 Daywo-
kes, & 3. *Pearches*. For those partes of *Pearches* omitted at your first
entering the Table worke thus. The halfe *Pearch*, quarter, or other
part of a *Pearch* in the length must be reckened by themselves in the
whole breadth, and those of the breadth contrariwise in the length. If
there be such odder partes in both, then reckon them of the length in the
whole breadth: and them of the breadth in the whole length: joining to
the other a forgotten, remembering the product of the one fraction mul-
tiplied in the other, to be pulled from the increase. To make this mat-
ter plaine, I will take this last ensample before. The one number where
with I should haue entred my Table was $49\frac{1}{2}$, the other $15\frac{1}{4}$. I found
first by entering with 49 and 15 (omitting the odder partes) 4. Acres
2. Rodes, 3. Daywokes, and three *Pearches*. Now for the increase of
the partes of *Pearches* left out, I must (as I sayd) reckon them of the
length, in the breadth, & contrariwise them of the breadth in the length.
Halfe $15\frac{1}{4}$ is 7 *Pearches*, &. Other quarters of $49\frac{1}{2}$ is 37. *Pearches*,
which added makes 5. *Pearches*. This adioyned to the number a-
forgotten, bringeth the whole content of the rounde figure, which is
4. Acres. 3. Rodes. 4. Daywokes, 3. *Pearches* and $\frac{1}{2}$ of a *Pearch*, &
product of the one fraction multiplied in the other subducted. What must
be done when the numbers wherewith ye should enter, exceede your ta-
ble, counsel the declaration of your table there adioyned.

Of the halfe Circle,

For this halfe Circle, enter the Table
with halfe this compasse, & with halfe
the diameter of the Circle, or with the
length of the picked hanginge line. k l.
So the content of this halfe Circle, is 2.
Acres. 1. Rode, 7. daywokes, 1 *Pearche*,
and $\frac{1}{2}$ of a *Pearche*



To measure
halfe circled
land.

An other ensample of Portions

and partes of a Circle.

Suppose n. m. o following were a part of a Circle, or peece of land,
whose content ye desire. The whole compasse of the Circle, which
this portion representeth, is (as aforesayde) 99. *Pearches* his Dia-
meter or breadth 34. The picked arc: e o compasse. n. m. o is 74.
Now with the halfe breadth or Semidiameter of the circle $17\frac{1}{2}$, and
with 77, the halfe of the picked compasse: enter your Table. So haue
we 3. Acres, 2. Rodes, 5. Daywokes, 2. *Pearches*, and $\frac{1}{2}$ of a
Pearch

Mountaynes' and Valleis

To measure partes of circled land.

Peare ch, the content of the peere of Lande full of pyches, to the cyres of the Triangle Pyched.

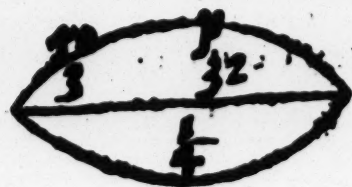
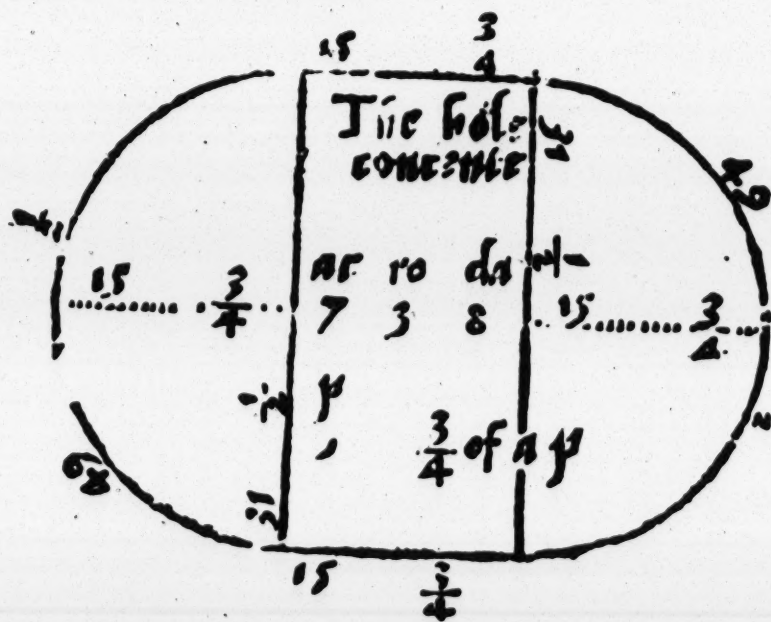
If yee desire to knowe the summe of Pearches in the other portion beneath the Triangle, separated by the line. m. o. ye must adde the content of the Triangle (which is 3. Rodes, and $\frac{1}{2}$ of a Pearche. founde by the rule of Triangles) to the Acres & Pearches before searched. We have yee 4. Acres 1 Rode 5. Daywoodes 3. Pearches, and $\frac{1}{2}$ of a Pearche, This subtracted or pulled from the number contained in the whole circle, the remainne is the Pearches included in the smal peere beneath the triangle. That is. 1 Rode. 36. Pearches, and $\frac{1}{2}$ of a Pearche.



Howe mixed Figures are measured.

Lande. com
ound of cir
cles or his
partes.

Thinke none now will doubt how these two figures followinge are measured, because they are made of portions or partes of Circles, whole measure is before sufficiently opened the one consistinge of two halfe Circles and a Quadzangle: the other beinge the portions of the Circle. m. o. doubled.



It ayme full fashioned lande chaunce to be measured, whiche requy-
reth to bee broughte in manie Triangles, to save labour yee may adde
some portion unto that, and make it square or other wise. So lett it then
be measured: and after from the product pul away that yee added: the
remainne is the content.

To find

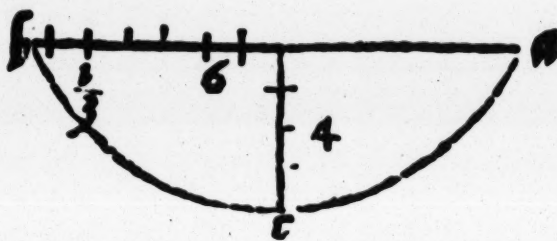
To finde the content superficial, of Ste-
ples, Columnes, Globes, and their partes.

TH the Arithmetician I say: For picked Steeples multiply the whole spere in halfe the Circumference of the base, addinge the playne of that base. For Pillers augment the circumference of the base in the height, putting to the playne of both Bases. For Globes; the Diameter in the circumference multiplied: even so of Fragments or partes. Let them that be hope of Arithmetike enter my Table of account following, with such numbers as I now willen the Arithmetician to multiply, not forgetting what I haue before written. So I serue their turne.

To measure Steples, Columnes, Globes &c.

Or thus by the rule of proportion the
partes of a Globe are founde.

Suppose a. b. c. to be a peece of a Globe, and 4 to be a portion of the diameter, the whole beinge 14. Thus I say 14. The whole Diameter geaeth 616. the contente superficial of this Circle, what shal 4 bringe: So haue 176. whiche is the content of that peece.



To measure partes of Globes.

To finde the Diameter by some known portion thereof.

If ye be ignorant what length the Diameter of that Globe is, whose portion ye haue the height or part of the Diameter beinge 4. foote augment halfe the line .a. b. which is 6. in himselfe & the producte Diameter deuide by 4. So haue ye 10 to be added to 4. which maketh 14 the whole of a Globe Diameter.

To find the vnknown Diameter of a Globe

The trewe measuring of Moun-
taynes and valleis

The vi. Chapter.

First ye shal measure the circuit of the foote, or base of the Mountain: then the compasse of the summit or toppet adding them together. So shal ye know of the Ascences, that is, the going vpper from the foote, to the top: loyning the measure of the longer and shorter in one. Now take the halfe of the circuits added, & the halfe part of the Ascences loyned, and enter your Table. There shal ye see the content.

To measure Mountaynes.

Ex.

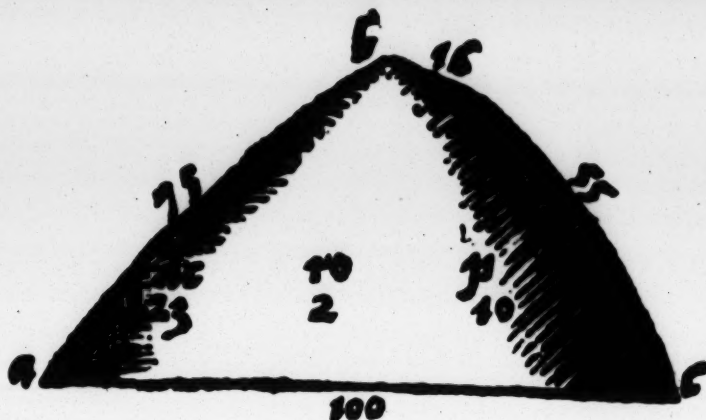
Example

Mountaynes and Valleis

Ensample.

Figure of a
mountayne

A. b. c. is the Mountain, a. c. the circuit of the base beinge 100, Perches, b. the toppe, 16. Perches. Which ioyned together make 116. b. c. the one ascense is 55. Perches: the other 75. These added make 130. The halfe of the circuits is 50. The halfe of the Ascenses 65. With these twoo summes ye shall enter your table of accomptes. where yee shall finde. 23. Acres. 2. Roodes and 10 Perchers, the true content of this figured hill.



Of the Valley.

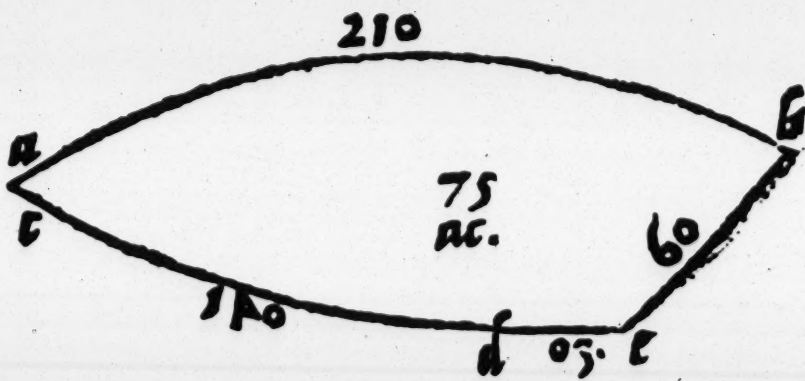
To measure
Valleis.

As in the mountayne ye measured the circuits of compasse of the base of the foote: so here contrary yee shall meate round about the circuit of compasse of the height of the Valley. And as ye gotte the measure of compasse of the toppe of the Mountain: so measure the circuit of the depth of the Valley. In like manner as yee measured the Ascense, that is the goinge up from the foote to the top, so measure the descense of goinge downe of the hill to the depth of the Valley. The rest all worke, as I haue shewed in measuring the Mountain.

For more playnnesse
behold this ensample of
figure.

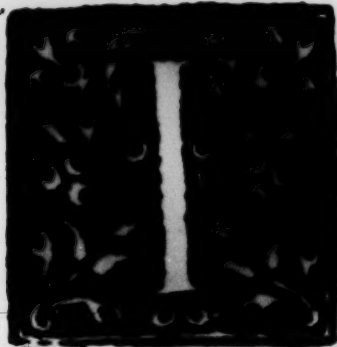
Figure of a
Valley.

If yee laye together the circuits of the height and depth whiche is 210. and 30. taking the halfe parte of those twoo circuits, making an 120 then the twoo ascenses 140 and 60. added in one product 200. the halfe thereof being 100 with this and 120 the other halfe of the circuit, ye maye enter your Table. That doing, los 75. Acres.



To the

To the Reader:



I commeth commonly to passe that Carpenters, Masons, and suche like Artificers, are put either to measure Timber every way, square or squared logges, by one on the one side then on the other. Manye times mutulate or supersece stiffe sometimes three, five, tenne, or twenty, square in the head, and so through oftentimes round stone or timber with hollowed etc. Also I shew unto them what must be done with such peeces of Timber or stone to get their true measure. my desire shalbe, that such craftes men will leaue to be heady or selfwilld, yea so greedily to stick to their old corrupted rules that utterly they refuse to be taught.

Both learning and experience declareth unto mee, that the grounds which the best of them haue are false. To open how and where it needeth not, neither dothe it appertayne to instruction. Onely it maye suffice him that liketh the true waye, here to receive it appoynted to him. Yet to satisfy and content him whiche will not beleue anye suche errors or false groundes to be, I saye (and truelye that the Ruler of Timber measure, which the most part of them hath, is not made by right arte. Besides that their craft in seekinge the square of some timber is very false. The vse in measuringe to lay the broader and narrower sides together in a summe, and so take the halfe of that number for the square. Then they seke this untrue square vpon the false ruler: and so measuringe the timber, they conclude of it truly.

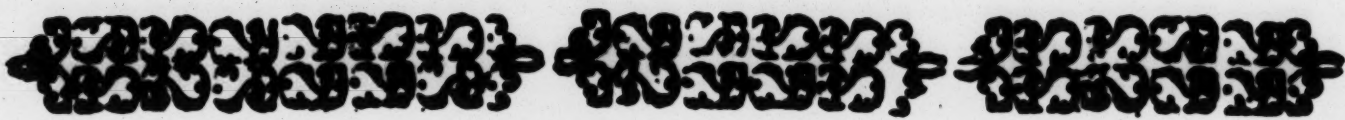
As this is corrupted, so are other groundes whiche they take to bee infallible. Nowe to the purpose, touching the correction of those errors with the other not mentioned, whereby true measuringe maye ensue, this way shalbe taken, After I haue opened how ye must handle all such fashioned timber (as afoze is spoken of) there shall followe a Table, in which ye maye finde (as I will declare) the square of any stone or Timber. That knowen, it is requisite to haue another Table immediately followinge, which maye appoynte to all true squares, from 1. to 6. Inches, the iuste length to make a foote every waye square. With the length agreeable to your square, your logge must be measured. And as ofte as ye finde it from the one ende to the other of your timber, so ofte ye maye conclude the foote square to be contayned

In a foote square is contained 1728 ynches,

The art of measuringe.

ned in that timber, Log, or stone: that is, so many square feete there to be included. This Table, of timber measure standeth in the place of a good Ruler, wel becket with true measures. By this ye may make or correct rulers at pleasure, as after appeareth.

Now orderly followeth the true measuringe of all sort of timber or stone also named.



Howe Timber or Stone, fouresquare

every way, or broader on the one syde then on the other, is measured.

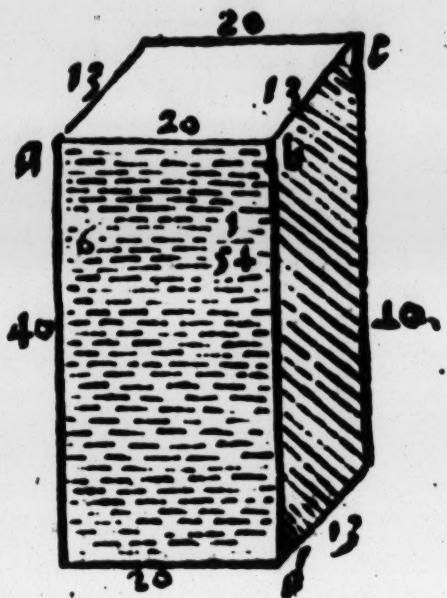
The vii. Chapter.

If a peece of Timber or Stone be either equally square, or broader on the one syde then on the other, ye shall take þ first measure, I meane how many Inches the broader syde containeth: even so of the narrower. This done ye muste seeke in the table of Squares followinge, the measure of the broader syde of the Timber or Stone, in the upper Margine of that Table. Then Look for the number of Inches of the equall or narrower syde, in the righte part and hanging Margine. At the common meeting, where the one number answereth directly to the other, there your true square shall appeare. This square so found shall be referred to your table of timber measure: in the which ye may plainly see (if you runne downe the left Margine, until your Inches square appeare) how many feete or Inches of your ruler belongeth to a foure square. As often as that measure here found is contained in the Timber or Stone so often and as many feete square ye may conclude (without doubt) þ peece of Timber or Stone to haue

Ensample

Suppose this squared Timber or Stone . a. b. c. d. were to be measured, the broader syde . a. b. 20. Inches, the narrower syde b. c. 12. Inches: the length 40. Inches. Now I must seeke the broader syde 20. in th:

in the upper Marginge of the Table. The narrower syde 13. muste be founde in the righte syde and hangings margine. At their common meetinge 16. Inches, and $\frac{1}{2}$ part of an Inch shall appeare. This true square must bee searched for in the Table of timber measure. Therfore looke for 16. in $\frac{1}{2}$ margine of this Table. In the squares with him rightward, yee shall fynde 6 Inches and $\frac{1}{2}$ which is the quarters of an ycher. Some deale lesse of your Ruler then .6. and $\frac{1}{2}$ layed out vpon the Timber, maketh a foote square And that measure so discretely handled, is contayned in the lengthe of your Timber sixe times. Therfore affirme sixe foote there to be, besyde that is left. $\frac{1}{4}$ parte of a foote. Note because the squares at all times (as in this example) wyl not to even Inches, but sometyms to odd partes. Therfore according to your discretion, adde or take awaye some part more or lesse in settinge forth the foote square, as aboue is perfourmed.



It were intollerable tediousnes, yea impossible to sette forth the true quantities of timber measure, to all odd quantitties of squares. The discrete handling of these the wittye shal bypasse to a sufficient exactnesse.

Of Timber or Stone. 3. 5. 10. 20: or mosydes Square. &c.

The eight Chapter.

When Timber haue diuers equall squares in the heade, and so through: first measure all the square spaces round about the head or ende of the Timber. Then take halfe the number of $\frac{1}{2}$ whole measure for the one breadth.

Then measure from the Centre (which is the middle of the heade, or ende of the Timber) to the middell of one square syde betweene the two Angles, and take the measure of that distance, for the other breadth. Nowe resorte with the measures of these two breadthes (as to fyre) to the Table of Squares: seekinge the bigger number of breadthe in the upper Margine, and the other lesser in the syde. Margine

The art of measuringe.

maeine with the Square there founde, haue recourse to the Table of Timber measure (and so as I haue instructed.

Ensample.

Admit this small peece of Timber 5. square e. f. g. h. shoulde bee measured, euerye side beinge .12. Inches. If ye adde together in one summe all þ 5 sides, they make 60 Inches. The halfe is 30. that serueth for one breadth. Then the line. e. f. whiche goeth from the Centres or middell of the square to the middle of one side is 8 Inches. The two numbers 30 and 8 must be soughte (as aforesaid) in the table of Squares following. At the common meeting your Square shall appeare .15. Inches and $\frac{1}{2}$. This Square 15. seeke in the Table of Timber measure. There ye may be righte with 17. Inches, and $\frac{1}{2}$. Nowe because of $\frac{1}{2}$. the odde quantity of the Square about 15. Inches, lay sometime lesse. Then see howe oftentimes that measure (so with discretion handled) is from the one ende of your Timber to the other: and affirme so many times a foote Square ther to be, as that measure is found in the length of your logge



How rounde and hollowed Timber,

Steples, Pillers, Globes &c. are to bee measured.

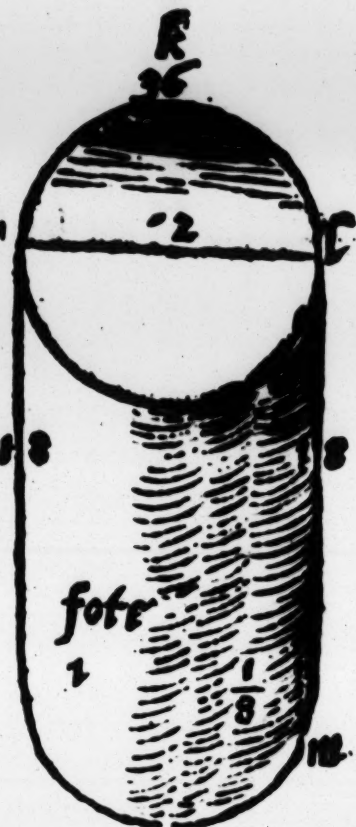
The ix. Chapter.

First gird the logge round about with some lynes: then deuide the line which compassen that Timber. in two equal partes, keepe the one part for the bigger breadth: After ye shall deuide agayne that whole length (the twenty and two part cast away) in three partes, and take the halfe of one of them for the other narrower Breadth. Which þ measures of these two breadthes, putt to your table, performinge all thinges as aforesaid is openen.

Ensam-

Ensample.

Suppose this little peece of Tymber i. k. l. m. were to be measured, the compasse of gyrding 36. Inches, the halfe of that is 18. beinge the one breadth: then the thirde part of 36. is 12. the halfe of it is 6. which is the other narrower breadth. With these two numbers 6. and 18. enter the Table of squares followinge, and so the Table of Tymber measure. At the last (all thinges performed as before) yee shall finde in this round Logge, (the length l. m. being 18. Inches. footes and .2 parts of a foote. This is sufficient for a such like.



A note of hollowed
Tymber.

If it chauce that hollowed Tymber bee to be measured: measure the whole Logge as though it were not hollowe, as above is declared. Then measure the narrower and broader side of the hollowe: and see what is contained in that, as though it were masse Tymber. Then pull out the contente of it, from the whole above measured: the remaine of foote must shewe what Tymber is included in that hollowed bodye.

I am unable in fewe wordes to expresse to the Unlearned, by what meane Pyramidall, or picked Regular, Steples of all fashions are measured. Also howe Pillers: how the content of Globes or Bowles are searched: unless the art of nombryng were taught. That being known: thus (as now followeth) I teach.

How the Crafftitude of picked
Steples is known.

Multiplye the plaine of the Base in the thirde part of the height: so ye have the Crafftitude. Or multiplye the concent superficial, all (sounde as I have instructed) in the height of the Steple: taken

The Arte of Measuring.

taking for your purpose the third part of that product.

Howe the contente of Pillers is known.

Encrease the base plaine in his altitude or height: so haue ye your
desire.

Howe Cubicall bodyes of Glo- bes are searched.

The content superficiall forme (as I haue opened) must be multi-
plied in the first part of the Diameter: the product is that ye re-
quire. Or the third part of the Superficial content in halfe the
Diameter: Or multiplye the plaine of the Circle in the whole Dia-
meter: then take two thirde partes, which added, make the crasse-
ness.

Of the halfe Circle.

His superficial content multiplied (as is sayd) bringeth the mag-
nitude of hym. If any man require examples, of this last mat-
ter, or more sufficient handlinge, let them resort vnto my
bookes published of Geometrie, there they shall bee satisfied. These
little appertayne to Carpenters or Platers, therefore not by example
declared.

A generall Note.

When thou shalt bee put to measure some bodye without order
or fashion, lacking parte of his square, or wanting more then
his forme: if it lacke, thou shalt make it perfect by observing
diligentlye the runninge together of the sides. The partes
wanting shall be measured as though they were there, which portions
must be taken from the whole body measured.

Also when there resulteth any more then the forme or Regular
square: first measure the square Body, then the crasse-
ness. All put together, doe shew the whole irregular Body. This
sufficeth.

Howe

Howe Tables, Bordes, Glasse, or any such
 like are measured, according to their length and
 breadth onely to the foote square,

The xi Chapeer.

This thing is performed by the helpe of a large table following:
 divided in five small Tables, and as many margines. The first
 and left margin beginneth at $\frac{1}{4}$. which is one quarter of an
 Inche, and extendeth to 6. Inches. as ye maye plainly per-
 ceine if ye runne downe by that Margine. This hath bys Table on the
 right syde answeryng unto hym. The other taketh his begynnynge at 6.
 Inches, and extendeth at 12. having bys proper Table also. The thyrde
 from 12. to 18. And so from 18. $\frac{1}{2}$. to 24. From 24 $\frac{1}{4}$. to 30. The laste
 margin is from 30. $\frac{1}{2}$ to 36. and there endeth.

Of this that is sayd, you may gather that everie margyne hath bys
 Table on his right syde. Also you must knowe that in the toppe and be-
 neath I have put (as in the Table of Tymber measure) these titles, foote,
 Inche, and partes to signifye fete, inches, and partes of an inch.
 Whensoever ye list to measure, Boarde, Glasse, or any other such, with
 the breadth of it enter chys Table, and seeke that breadth in bys proper
 margine, There ye shall finde in righte order howe many fete, inches,
 or partes of an Inche, belonge to a foote square. So often as the mea-
 sure is in your stuffe, iuste as many fete have ye in that boarde or such
 like. If the breadth excede this Table, then divide the breadth in partes,
 and worke as is and shall be declared. So the ingenious applyeth chys
 Table for all maner breadthes most exactly.

Ensample.

Suppose I have a Pane of Glasse or a Boarde, whose breadth were
 2. inches $\frac{1}{4}$. the length 16. fote. In the fourth margine I find this
 breadthe 21. and $\frac{1}{4}$. And even with it in the Table rightward I see 6.
 Inches $\frac{1}{4}$. So much of my ruler wantynge some small quantite ma-
 keth a fote. Nowe because in the length of my Boarde (which is 16.
 fote) that measure is founde 29. times, and $\frac{1}{4}$. partes. I concluded 29.
 fote there to be, and two thirde partes of a foote square, accordinge to

Fo Yn			Fo Yn			Yn Par			Yn Par			Yn Par			Yn Par									
$\frac{1}{4}$	48		6	$\frac{1}{4}$	11	$\frac{1}{25}$	12	$\frac{1}{4}$	11	$\frac{3}{4}$	18	$\frac{1}{4}$	7	$\frac{7}{8}$	24	$\frac{1}{4}$	5	$\frac{15}{16}$	30	$\frac{1}{4}$	4	$\frac{3}{4}$		
$\frac{1}{2}$	24		6	$\frac{1}{2}$	10	$\frac{1}{7}$	12	$\frac{1}{2}$	11	$\frac{1}{2}$	18	$\frac{1}{2}$	7	$\frac{4}{5}$	24	$\frac{1}{2}$	5	$\frac{7}{8}$	30	$\frac{1}{2}$	4	$\frac{5}{7}$		
$\frac{3}{4}$	16		6	$\frac{3}{4}$	9	$\frac{1}{3}$	12	$\frac{3}{4}$	11	$\frac{2}{7}$	18	$\frac{3}{4}$	7	$\frac{2}{3}$	24	$\frac{3}{4}$	5	$\frac{4}{5}$	30	$\frac{3}{4}$	4	$\frac{2}{3}$		
I	12		7	1	8	$\frac{4}{7}$	13	11	$\frac{1}{16}$	19	7	$\frac{4}{7}$	25	5	$\frac{3}{4}$	31	4	$\frac{5}{8}$						
$\frac{1}{4}$	9	7	$\frac{1}{5}$	7	$\frac{1}{4}$	1	7	$\frac{7}{8}$	13	$\frac{1}{4}$	10	$\frac{7}{8}$	19	$\frac{1}{4}$	7	$\frac{1}{2}$	25	$\frac{1}{4}$	5	$\frac{2}{3}$	31	$\frac{1}{4}$	4	$\frac{5}{8}$
$\frac{1}{2}$	8		$\frac{1}{2}$	7	$\frac{1}{5}$	1	7	$\frac{1}{5}$	13	$\frac{1}{2}$	10	$\frac{1}{2}$	19	$\frac{1}{2}$	7	$\frac{3}{8}$	25	$\frac{1}{2}$	5	$\frac{5}{8}$	31	$\frac{1}{2}$	4	$\frac{4}{7}$
$\frac{3}{4}$	6	10	$\frac{3}{7}$	7	$\frac{3}{4}$	1	6	$\frac{4}{7}$	13	$\frac{3}{4}$	10	$\frac{3}{4}$	19	$\frac{3}{4}$	7	$\frac{2}{7}$	25	$\frac{3}{4}$	5	$\frac{5}{8}$	31	$\frac{3}{4}$	4	$\frac{1}{2}$
2	6		8	1	6		14	10	$\frac{2}{7}$	20	7	$\frac{1}{5}$	26	5	$\frac{1}{2}$	32	4	$\frac{1}{2}$						
$\frac{1}{4}$	5	4	8	$\frac{1}{4}$	1	5	$\frac{3}{7}$	14	$\frac{1}{4}$	10	$\frac{3}{8}$	20	$\frac{1}{4}$	7	$\frac{1}{8}$	26	$\frac{1}{4}$	5	$\frac{1}{2}$	32	$\frac{1}{4}$	4	$\frac{1}{2}$	
$\frac{1}{2}$	4	9	$\frac{3}{5}$	8	$\frac{1}{2}$	1	4	$\frac{15}{16}$	14	$\frac{1}{2}$	9	$\frac{7}{8}$	20	$\frac{1}{2}$	7	$\frac{1}{3}$	26	$\frac{1}{2}$	5	$\frac{3}{7}$	32	$\frac{1}{2}$	4	$\frac{3}{7}$
$\frac{3}{4}$	4	4	$\frac{3}{8}$	8	$\frac{3}{4}$	1	4	$\frac{7}{8}$	14	$\frac{3}{4}$	9	$\frac{3}{4}$	20	$\frac{3}{4}$	6	$\frac{15}{16}$	26	$\frac{3}{4}$	5	$\frac{3}{8}$	32	$\frac{3}{4}$	4	$\frac{3}{8}$
3	4		9	1	4		15	9	$\frac{5}{8}$	21	6	$\frac{6}{7}$	27	5	$\frac{1}{3}$	33	4	$\frac{1}{3}$						
$\frac{1}{4}$	3	8	$\frac{1}{3}$	9	$\frac{1}{4}$	1	3	$\frac{4}{7}$	15	$\frac{1}{4}$	9	$\frac{3}{7}$	21	$\frac{1}{4}$	6	$\frac{4}{5}$	27	$\frac{1}{4}$	5	$\frac{2}{7}$	33	$\frac{1}{4}$	4	$\frac{1}{3}$
$\frac{1}{2}$	3	5	$\frac{1}{8}$	9	$\frac{1}{2}$	1	3	$\frac{1}{7}$	15	$\frac{1}{2}$	9	$\frac{2}{7}$	21	$\frac{1}{2}$	6	$\frac{5}{7}$	27	$\frac{1}{2}$	5	$\frac{2}{9}$	33	$\frac{1}{2}$	4	$\frac{2}{7}$
$\frac{3}{4}$	3	2	$\frac{2}{5}$	9	$\frac{3}{4}$	1	2	$\frac{3}{4}$	15	$\frac{3}{4}$	9	$\frac{1}{8}$	21	$\frac{3}{4}$	6	$\frac{5}{8}$	27	$\frac{3}{4}$	5	$\frac{1}{5}$	33	$\frac{3}{4}$	4	$\frac{1}{4}$
4	3		10	1	2	$\frac{2}{5}$	16	9		22	6	$\frac{1}{2}$	28	5	$\frac{1}{8}$	34	4	$\frac{1}{4}$						
$\frac{1}{4}$	2	9	$\frac{7}{8}$	10	$\frac{1}{4}$	1	2	$\frac{1}{21}$	16	$\frac{1}{4}$	8	$\frac{6}{7}$	22	$\frac{1}{4}$	6	$\frac{1}{2}$	28	$\frac{1}{4}$	5	$\frac{3}{32}$	34	$\frac{1}{4}$	4	$\frac{3}{16}$
$\frac{1}{2}$	2	8		10	$\frac{1}{2}$	1	1	$\frac{3}{4}$	16	$\frac{1}{2}$	8	$\frac{3}{4}$	22	$\frac{1}{2}$	6	$\frac{3}{8}$	28	$\frac{1}{2}$	5	$\frac{1}{16}$	34	$\frac{1}{2}$	4	$\frac{1}{6}$
$\frac{3}{4}$	2	6	$\frac{1}{3}$	10	$\frac{3}{4}$	1	1	$\frac{1}{8}$	16	$\frac{3}{4}$	8	$\frac{5}{8}$	22	$\frac{3}{4}$	5	$\frac{1}{2}$	28	$\frac{3}{4}$	5		34	$\frac{3}{4}$	4	$\frac{1}{8}$
5	2	4	$\frac{4}{5}$	11	1	1	$\frac{1}{11}$	17	8	$\frac{1}{2}$	23	6	$\frac{1}{4}$	29	5		35	4	$\frac{1}{8}$					
$\frac{1}{4}$	1	3	$\frac{3}{7}$	11	$\frac{1}{4}$	1	$\frac{4}{5}$	17	$\frac{1}{4}$	8	$\frac{15}{32}$	23	$\frac{1}{4}$	6	$\frac{1}{5}$	29	$\frac{1}{4}$	4	$\frac{7}{8}$	35	$\frac{1}{4}$	4	$\frac{3}{32}$	
$\frac{1}{2}$	1	2	$\frac{1}{5}$	11	$\frac{1}{2}$	1	$\frac{1}{2}$	17	$\frac{1}{2}$	8	$\frac{1}{5}$	23	$\frac{1}{2}$	6	$\frac{1}{8}$	29	$\frac{1}{2}$	4	$\frac{7}{8}$	35	$\frac{1}{2}$	4	$\frac{1}{16}$	
$\frac{3}{4}$	1	1	$\frac{1}{23}$	11	$\frac{3}{4}$	1	$\frac{2}{7}$	17	$\frac{3}{4}$	8	$\frac{3}{32}$	23	$\frac{3}{4}$	6	$\frac{1}{16}$	29	$\frac{3}{4}$	4	$\frac{5}{6}$	35	$\frac{3}{4}$	4	$\frac{1}{12}$	
6	2		12	1			18	8		24	6		30	4	$\frac{4}{5}$	36	4							
Fo Yn			Fo Yn			Yn Par			Yn Par			Yn Par			Yn Par									

The Arte of Measuring. Fo 11

the length and breadth. I suppose (wanting some small quantitie) because of the point ioyned to this fraction, which is put to diminish the fraction some little things, as is declared plainly in the other Tables before put forth.

He that desireth to measure Chamber floores, Pavementes, or such like, let him onely multiplie the breadth wth the length, so the product sheweth the content.

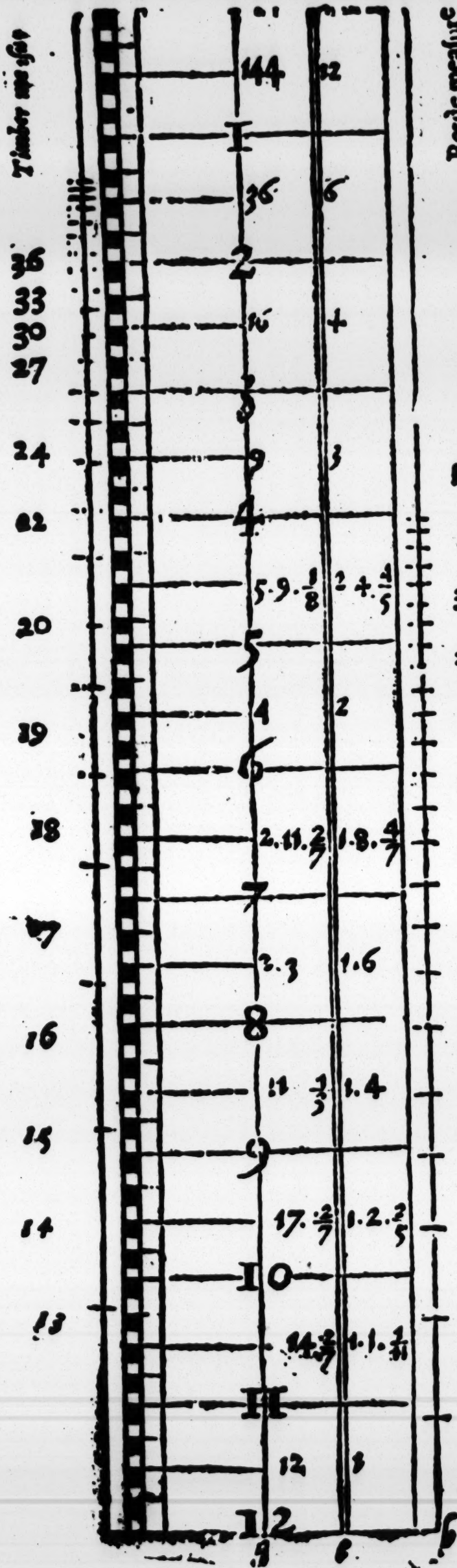
Ensample.

If there were a pavement 100. foote long, and in breadth 50. I muste needs conclude (by multiplication of the length in the breadth) there to bee contained 5000. foote.

Or thus without Arithmetike when
the breadth exceedeth the Table.

Divide the breadth in partes (as is opened in the declaration of the Table of accomptes) and worke as I have before Instructed. So for Pavementes all maner wayes it serveth your turne. Of this matter to put forth Tables, were superfluous, tediousnes and tollie. The ingenious with these sayre, will bee satisfied.

The



The Carpenters Ruler.

The face of the Carpenters Ruler, figured with the true measures, and other things necessary.

The xij. Chapter.

Because the effect of this Ruler is above declared by Examples, an Instrument also well known and common among good Artificers, I will not spend many words in opening it. Behold the figures, and learne by them howe ye ought to make, and commonly to decke your Ruler, both with Timber and board measure.

Ensample.

Supposeth the ruler to be a. b. c. d. twel p'posed, twelue Inches long, a quarter of an Inche thick, and two Inches in breadth. Truly it were more commodious, if it had two foote in length. This Ruler here imagined but a foote in length is deuised firste in twelue euen partes, called Inches: then euery Inche in halfe, or two equall portions: eche halfe in two quarters: euery quarter in foure or twoo parts at the least: as in this ensample. Then are the figures placed from 1. to 12. manifestinge the Inches. Thus your Ruler is readye to receiue the measures whiche are marked or figured on your Ruler thus. And first the Timber measure as followeth,

Ye shall referre to your Table of Timber measure, and seeke howe many foote belongs to one Inche square: there ye shall finde 144. This number note, wryte, or rather graue, where this figure 1. representinge one Inche, is figured as ye may see in the middle between the lyne e. f. and the lyne of the figure g. h. This done referre to your Table againe, & behold how many foote and parts 2. Inches square requirith. So shall ye finde: 5. foote, which is placed in the nexte rowne leftward, under the character 2. signifieth two Inches. Thus the rest foote, Inches, and partes, founde in your Table, untill you come to the 12. Inche, where ye shall perceiue 12. Inches onely to be set in his proper rowne &c. Then seeke further in your Table, what belongeth to 13. Inches: & 10. Inches and .1. This muste bee numbered in the lyne c. a. from c. which line betokeneth the thickness of the Ruler. Make ther a little stroke vpon that grosse line, euen as right agaynst the measure 10. What needs many wordes? Thus do untill ye come to 36. Inches, and that is noted (as the Table of Timber measure sheweth) right with 1. Inche, and .1. from c. No other waye is performed of booke measure, as ye may beholde set forth by the helpe of his proper Table in the square rownes, beneath the lyne c. fi and also the other thickness of lyne b. d.

The Carpenters Ruler

The backsyde of the Ruler with the Qua- drant Geometricall.

The xiiij. Chapter.

The making
of a Geome-
tricall qua-
drant.

Notethese
three princi-
pall lines.

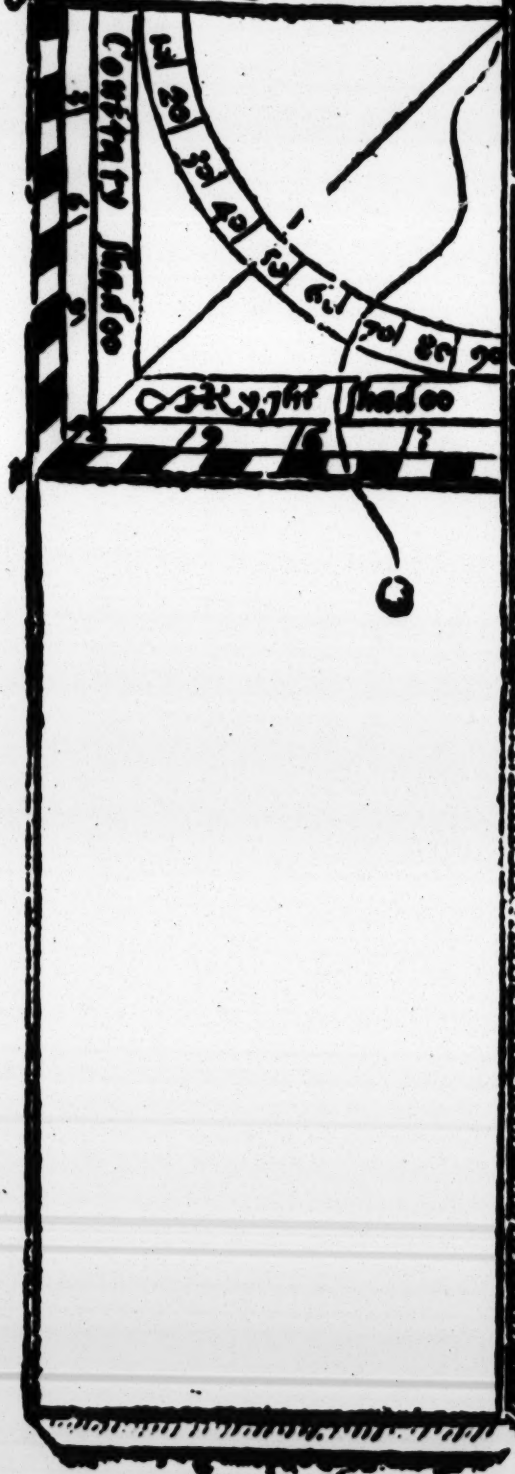
The devi-
ded sydes o.
p. and p. q.
are called
the Scale.

This other figure i. k. l. m. is the
backsyde of your Ruler, ha-
ving in the middell of Geome-
tricall quadrant n. o. p. q. whose ma-
kinge in fewe wordes is thus expre-
sed. The line o. p. breadth of your Ru-
ler n. o. that line, o. p. p. q. q. n. ought
to be of one equal litle lengthe, cut-
ting ech other squerewise. And from
the Centre n. unto p. is drawen an
other lyne, whych is called the lyne
of heightes. This is o. n. the lyne of le-
uel q. n. the line of heightes vpryght.
This knowen I open my compasse,
one foote remaininge in the Centre
n. the other extended in the Lyne of
leuel almost to o. making a Circum-
ference unto q. n. which is a portyon
of a Circle named a Quadrant: and
ought to be deuided into 90. equall
partes, as ye maye beholde euery of
them called a degree. Ye may deuyde
the Lynes o. p. p. q. named the Scale
eche in 12. as here, or in 60. yea in
100. quall portions is moze meete,
for the vse of shadowes, Hightes,
Lengthes &c. Note that the syde o.
halfe Scale .o p. is called the Con-
trarye shadow p. q. Righte shadowe.
Remember that vpon the thickenesse
m. k. ye ought to haue two litle equall
square lightes, well boxed, represen-
ted here by r. s. made of woode, or ra-
ther metall, to be fastned there when
easing requireth, let this suffice.

The

The backside
of the ruler.

Lyne of leuel.



The lyne of heightes vpryght

The common vse of the Carpenters
Ruler, touching the face afoye put forth.

The xiiij. Chapter.

Suppose a peece of Timber to be moaten, whose true square is. 7. The eight Inches, this square appointed you to the figure of. 7. in the line. g. Chap. shew h. under whom rightward in the place assigned to Timber mea-eth how the sure, is written. 2. foote. 11. Inches. 2. As often as that measure is founde true square in the length of your Timber, so many foote of Timber is in that is found. peece.

An other Ensamble.

Imagine your square to bee. 22. Inches: set it in the line a. c. Note then how much of your Ruler is left from that to the ende of your Rule c. and so much belongeth to a foote. Therefore lay out that measure vpon your Timber, and reckon how many tymes yee may finde it, from the one to the other of your Loggs: for so many foote of Timber is there. Euen thus of Bayes. Make the breadth vpon your Ruler, in the same or place of bayes measure, and immediately before your eyes there remayneth what is to be layed out to make a full foote of bayes.

The vse of the principall lynes in the
Geometrical Quadrant on the backsyde of
the Ruler, and first of the Leuell lyne.

The xv. Chapter.

I behoueth you to looke through your sightes. q. r. placed in the thickness of lyne k. m. a line thred and plummet falling a liberty out of the Centre n. If this plummet and thred chance precisely on the lyne of Leuell (which is n. o.) what soeuer yee see through the sightes, is leuell with your eye: if otherwise, the thing that yee looke vnto is not leuell, eyther more or lesse then the height of leuell of your eye: Note if the Plummet fall to yourwarde: Less, if contrary.

C.

How

The vse of the Howe by the lyne of Leuell to foresee whether the water of any springe or head is possible to be brought to a place appointed and also to iudge the hollesomes of it.

The xvi. Chapter.

Ye shall go to the head or springe and set your Ruler to your eye (being in height equall with the water) so that the line come and Plummert fall perfectly in the lyne of Leuell. Some if they see the lightes yet may see about the place, knowe and iudge the water possible to be brought, if your sight fall under: impossible. It cometh commonly to passe when the place to the which ye would haue water conueyed, is of some greate distaunce from the head, then hilles, valleys, and such like impediments lette the lyne by itselfe to haue his free course: wherefore this remedye is provided: At the head of the springe, yet shall looke thowaine the syghes (as before) and note a mark in the next byll toward the place, then goe to the marke: in lyke manner obserue there another in some byll: so for the byll by any of them ye maye perceiue the place desired. If then your sight running through the pinnes of your Ruler, (the threde ever fallinge on the lyne n.o) exceede that place, the conueying of your water is possible, otherwise not.

Now by the way by itselfe ye shal be instructed howe ye may knowe the hollesomes of water.

Howe good water is knowen.

Take a cleane pot & put water in it: so set it on the fyre: after a litle boyling, poure it out: if then no filth remaine in the bottome of the potte, it maye be iudged the hollesomer. Or thus, Let fall dropes vppon metall, or rather on glasse (any of them being polished) and suffer that to dry by it selfe if after there remaine no spot or signe, it is a good token. Moreover if your water be sweete, pure, cleare, light, or of litle weight, it followeth the water to be hollesome for the vse of man.

Of the

Of the lyne of Height.



Then lower the thebe and plummet to chauce fullie on the height which is n.p the altitude or height that yee see is even with the distance from the middle of your feet to the neither part directly under the toppe equall with your standing, addinge the height of your eye downward, knowe that ye must ever stand upright with bodye and heele, your feet fast together, the one eye closed. &c.

The lyne of vpright.
Altitudes.

If ye also anye thinge plumb upright when the thickness of your Ruler i.l is closely thereon, the plummet then at libertie, fallinge on q.n. named the lyne of heightes upright. Now followeth the vse of the Scale.

To search out heightes by the Scale
with the ayde of two places.*The xvij. Chapter.*

Let the thebe and plummet fall in the one, on the 12. pointes: in the other station, on the 6. of the right shadow: double the distance betwene the two places, the summie appereth from that parte of the thinge measured, which is equall in heighte with your eye. Or the one in the 12. the other in 3. of right shadow: then triple the distance. The one in the 12. the other in 6. of right, quadruple the space. The one in the 12. the other in 6. of the contrary shadow, then the space betwene both the stations is equall with that ye measure, ever understanding from your eye upward. Even that same seemeth to passe, if in the one the thebe be founde upon the 6. of the contrary, in the other on the 4. of the same, or the 4. and 3. of the contrary. In all these the spaces are equall with the Altitudes. So then in measuring the distance betwene the two places, ye have the height, from your eye upward, putting to it the length from your sight downward, the whole Altitude appereth: the base being equall with your standing.

E.g.

I would

The vse of the

Howe
lengthes in
height are
known.

I would not haue you ignorant here how to knowe lengthes which be in height not only to come unto. For (as before) got the height of the toppe, the altitude of the base or longest parts of your length. Subtract the lesse height out of the more, of force your desired length remaineth. Or thus: Let the plummet & threde fall in the 12. marke your place: go in toward the thinge (the threde as it was) untill pee see the base of that length: the distance betwene the two standings, is undoubtedly the length.

How with the Scale direct or vpright heightes, by theyr shadowes are declared.

The xix. Chapter.

Turne your lesse syde vnto the Sunne, sufferinge his beames to pearce both your sightes q.r. placed as afore is sayd in the thicknes of lyne k.m. The threde of plummet then hanginge at liberty out of the Centre n. sheweth aswell the Degrees of height to bee counted from o. as the partes of the Scale cut. If your threde bee founde in the 12. part, or lyne of length, shadowes of all thinges being perpendicular eleuent, are equal with their bodies. If the plummet with the threde be perceyued cuttinge the partes nexte to the sightes, which I name poynctes of the right shadowe, then euery thinge direct is more then his shadowe, by that proportion which. 12. exceedeth the partes, where the threde was founde. If it fall in 1. that is the first parte of the right shadowe, take the shadowe twelue times to make the height. In two, that is the seconde parte, sixe times. In the thirde foure times: in the fourth, thre times: in the fift thre: and $\frac{1}{2}$. of the shadowe: in the sixe, twise: in the seventh once, and $\frac{1}{2}$. in the eight once and $\frac{1}{2}$. in the ninthe once, and $\frac{1}{2}$. In the tenth once, and $\frac{1}{2}$. In the eleuenth pee shall take the shadowe once, and $\frac{1}{2}$. part of it.

Right sha-
dowe.

If the arte of numbring were had, I would tell you to multiply the length of the shadowe by. 12. and the product diuide by the partes, in the which pee founde the threde.

But and if it be in the partes of the contrary shadowe, augmente the

the length of the shadowe w^{ch} the partes declared by the plummet : & the increase denieth the by 12. so cometh the altitude also.

Contrary
shadowe.

Thus the composition and whole appliaunce of the Carpenters Ruler is shewed : therefore somewhat shalbe now sayd of the squire.

I am not ignorant that the common vse of him is better knowne then I can with many wordes expresse, wherefore I leaue to write in that behalfe. Notwithstandinge I will declare howe Hightes, and lengthes are taken - &c. matters rare, and knowne of fewe Artificers. Also by tables to get a true knowledge of the daye houre, and what diuers wayes, w^{ch} the helpe of the squire, as is opened in my generall Prognostication augmented in the yere of our Lord. 1556.

VVhat length the sides of thy Squire ought to be, and the deuision of him

The xx. Chapter,

I Meene not to put forth the exacte making of this instrument so well knowne. Loe therefore the figure.

One syde supposed two foote from the inwarde Angle : and the other a full foote from the same. The longer a. b. inwardly deuised from the Angle a. vnto b. into 24. equall principall partes, and euery of them into a lesse (if ye list) eche contayning. 10. minutes. Also the syde. c. d. in the outwarde contrary, playne from the toppe c. vnto d. is deuised into. 12. eue portions : and againe (if ye require exactnesse) euery of them into 6. eche of value. 10. minutes. Behold a lyne of plummet falling from c. to f. a parallel to c. d. and a. b. Thus this squire is well framed for the vse of diuers Tables put forth in my generall Prognostication, and also for the findinge of Altitudes and Longitudes, which here I purpose now : briefly to open.



Howe

The vse of the How by the Squire heightes are knowne.

Altitudes of heightes are founde, the line of Plumbet centered in the 6. point, cutting h. the middle of a. g. The mouable sightes placed in a. g. of a parallel from that line, not unlike as is opened of the line of heighte, in the backe of my ruler.

Howe Lengthes in plaine ground are searched by the Carpenters of Masons Squire.

The xxi. Chapter.

Take a staffe deuised into certayne porcions as yee like, in a 100. or a 1000 partes. At the beginninge of your lengthe vpon the beere toppe directiue standynge: set the inward Angle of the Squire: liſte vp or put downe this instrument untill ye see the farrest part of your longitude. I meane untill your sighte running from that Angle, to the ende of your Squire come vnto the farrest parte of that length. The Squire so remainynge, and the staffe not remoued from his heighte, marke where the other ende of the Squire next vnto you notes vpon the grounde. See what proportion the staffe then beareth to the part of the grounde, which the nearest ende of the Squire pointed vnto from the staffe. the same shall the Length haue to the quantitie of the same staffe.

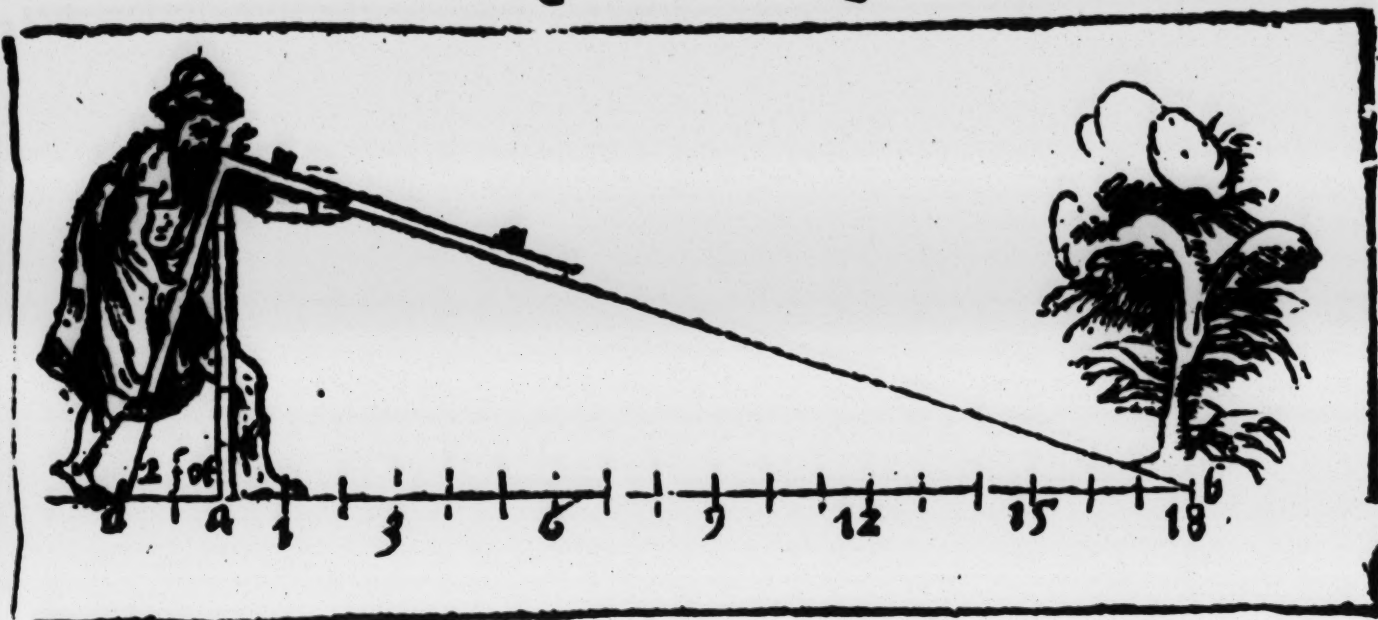
Ensample.

The cause is
take oute of
Euclide, 33.
pro 1. booke
and the 4.
pro 6.
booke.

The staffe a. c in this figure is imagined 6. fote and the space a. d 2. fote. Considering now that 6. the length of the staffe containeth 2. thysse, therefore the longitude desired a. b. of fotes muste containe thye times the staffe (whych staffe is 6. fote,) that maketh 18. fote. As this is proued by a small Grounde in the figure followinge: for the arte sayeth not in a greater space, which the good speculator & diligent practiser by anye waye can not denye. Yet experyence willethe me this to confesse, that the Squire is not convenient for any longe distance, but the instrument Geometricall (whose making and vse yee maye perceiue in the treatise followinge) vntill yee assende some Tower or Turret for your ayde, which length knowne shall stand in the steepe of your staffe.

It be

Carpenters Squire.



A Note.

It becometh you to haue a fyne cord, made fast in the upper parte of your staffe c. which shall bee tyed even with the inward edge of the Squire, and so by a line to the Grounde, where the neare ende of the square from the staffe pointeth, as ye see d. c. the other ende then truely directing to the farrest distance.

Know that the Grounde must be very playne and leuell, otherwise error ensueth.

Thus the vse of the Squire is here somewhat declared, but more in my generall Prognostication, yea most plentifully hereafter (God sparing my life) in a Booke titled the rare vse of the Squire in practises Mathematicall: in the which booke profitable pleasant experiences shalbe plainly opened (only of mee practised) as well of Perspective, as of the Mathematicals in general.

I had thoughte here following to haue placed the ready handlinge of the compasse, yea and to haue shewed the figuring and true making of al maner Letters, both Text and Romanne, with the best proportion, the quantity as ye would demaund besides that. So to place them in height and nearer to the sight, that they being of diuers magnitudes might appeare to the eye, of one bignes. This, when I did attempt to bringe to the capacitee, seemed somewhat difficulte without penninge manye wordes. Wherefore I omitted it, belonging rather to the Painter then to the Carpenter. For whose sake only the rest aforesaid seemeth to be compiled. Here after (as I see men desirous) my endeour may be to adde that and other thinges necessary.

A little

Carpenters Square

A LITTLE TREATISE
 declaringe the makinge and vse of an instru-
 mente Geometricall, so far as it fardereth the Landmea-
 sure of Carpenter, named the im-
 mutable Staffe.



To the Reader.

I Sayde in the beginning that no little booke would
 containe the makinge, and manifolde fruits of
 this Princely Instrument, if it were set forth as
 it ought to be.

Certes the truth euen bere maketh me confesse the same: yea. He that desy-
 reth mani-
 fold fruites
 of this in-
 strument, le-
 get. Gemme
 fricij de radi-
 o Astrono-
 mico & Geo-
 metrico, li-
 brum.
 that there is no instrumente so generall and profitably plea-
 saunte. Notwithstandinge knowe (gentle Reader) that the
 occasion of his chiefe vse and profite is not bere ministred: nei-
 ther to say the truth, doth it appertayne to, or agree with the
 capacity of such Artificers. Therefore I shall leane to intreate
 of his ample large vse and best making, and wil set him forth
 in few wordes: yea sufficiently for the Landmeaters capacity
 or Carpenters purpose, that at the least they may receive som
 kind of fruite with the Geometrer. And in time to
 come (by other meanes) as I see cause I will large-
 ly declare and there decke him with
 his proper beauties. Here now follo-
 weth the making, and so briefly
 how he is applied for the pro-
 fit of the aforesaid
 Artificers.

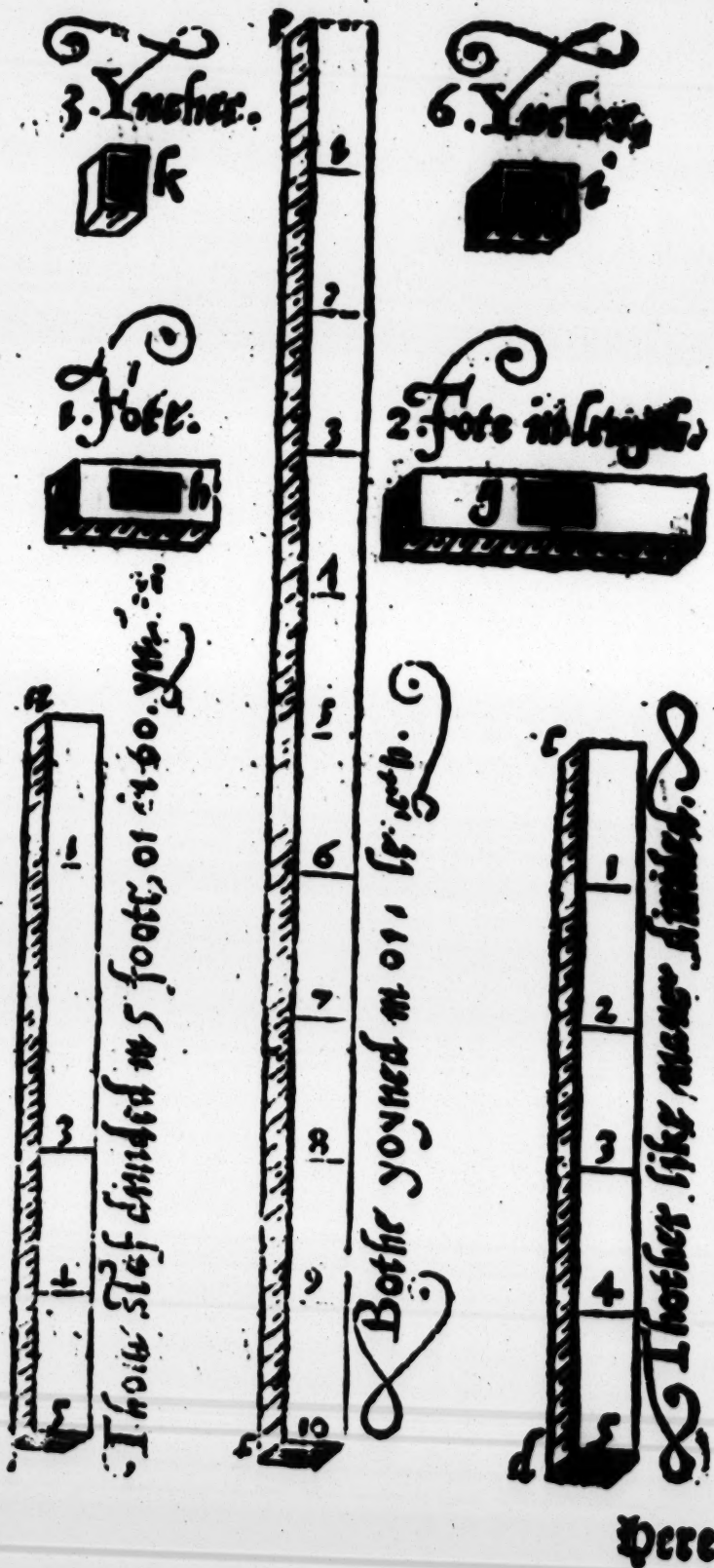
The vse of the The making of this profitable Rodd of staffe.

The firste Chapter.



Ye shall prepare two small, stright, stiffe, round or rather square Roddes, of metall or of wood well playned, of like bignesse and length, although it make no matter of what length, yet to avoide the errors, whych little Instruments, and those staves being, and also to beare with

the rude and untried handling of such Artificers: lette your Roddes bee each sixe, or at the least three fote, and euery fote divided in 12. even parts or inches, as yee see a. b. c. d. These rodde must bee forged with a vice in the end of them to lyeue readily 10. or 6. fote in length, (when time requyret) as the Figure e. f. sheweth. Also ye must get (by the helpe of some craftsman. 4. other like Roddes, the longer g. 2. fote: the next h. 1. fote: the other i. 6. inches then k. 3. inches, the last and shortest l. 1. inche. and .1. Each of these must haue in their middell a boole, that the longe staffe of 10. fote may be put thorough them and they moved on by at pleasure up and downe, alwayes cutting the longer staffe e. f. squarewise, and made to sarpe on any diuision as occasion shalbee ginen: whych all are easie to be perceyued by the figure followinge, although by my rude declaration hath not expzelled my meaning.



There note in the first of your short staves, ye shal have one crooke staffe two foote longe, with current lightes, so artificiallly made, that alwayes the short staffe shall runne square vpon the longer, and the lightes distant, as ye shal place them.

Things needefull to be knowen before the vse of this instrument.
is opened.

The ij. Chapter.



Before I entreat of his vse, it behoueth to knowe thinges necessary, & first which of the 5. little staves g. h. i. k. l. mentioned in the making, is to be put vpon your long staffe c. f. according to the distance of the marks. Note, if your marks be nere hand, be it length, breadth, or height, the longer g. doth seme meetest to haue the roume if more of length, the other h. & so the farther distance the shorter the staffe requirith to be, which shal occupie that place. Of practise sheweth this better then many wordes. Also note, if chauce be to go in to mark your marks (as after ye shal see how) you must moue the short staffe inward more nere to the end of the longer c. If ye be compelled to go from it, then put it from c. toward the end f. Also remember when ye are appointed to measure any breadth or length (as shal be declared) it behoueth you to stand right with, and against that breadth: yea and the longer the breadth, or larger the width or length is, the better the thinge will come to passe: And for heightes it is necessary (if ye regard all perfectures) to haue the height stand directly vp.

Note this that foloweth to be generall in all workinges.

Ye must stande right vp with your Body and necke, your feete fast together, your handes not much mouing, the one eye closed and euer markes your standinge righte with the midst of your feete. Be not ignorant here, that I call the extreames of the little
J. ii. staves

The vse of the

Vhat these woordes meane' Longi- tude, Latit- tude, Alti- tude. the flanes, the very endes where the sight ever runneth. And as differ- rance betwene the Altitude and height, betwene the Longitude and length: the Latitude and breadth. The shorter flanes I name by the letter figures ever chosen. Your eye must ever be placed in the end of the longer staffe e and with the other eye ye ought to twinke. These tryles and such like omitted letteth the truth to come to passe and make men to suspect the ground, which is most certayne.

How heightes standing directly vppe *are measured by the Instrument*

The iii Chapter.

Let the staffe g. vppen the longer e. f. and move him his full lengthe from the beginning of the longer e. turne the endes of g. towards you, and according to that height: placing your eye (as is sayde) ever at the beginning of the longer e. with the other eye twinke. Then goe backe until ye may plainly perceiue the very upper part of that Altitude, and also the lower end, by the extre- mes of your shorter staffe g. Now the space from the middle of your foote to the base of the height, is equal with the Altitude.

Or thus

When ye shal see any Altitude. whose measure ye require, imagine by conjecture how oftentimes that height is founde in the space from it unto your standing. Then move your shorter staffe (chosen as above most convenient) even as often his owne lengthe. from the beginning of the longer e. where your eye is ever placed. This done, turne the endes of your little staffe, your eye beinge in e. according to the height: looke whether ye may see by the extreames of your shorter the very toppe, and also the lowest part of the height. If not move the shorter a length further toward f. or nearer to e. as ye see cause, and as your conjecture sayled. O, lette your little staffe remayne, as by conjecture he was put, and goe toward or from that height until the Altitude agree fully with the extreames of your shorter staffe. Then marke that place with the middle of your foote.

Nowe ye maye conclude, that the height is as often contained in the

the distance, which is between the marks and it, as the Length of that little staffe is found remoued from the end of the longer &c.

Ensample

If the shorter staffe be ten times his owne length from c. affirme the height contained in that distance 10. times onely.

Howe the
just heighte
is knowen.

The Altitude is thus gotten. Spere your shorter staffe from his late being a length eyther towards or from c. as ye list to goe in or backe. When goe frowe or neare unto it (as afoze) untill the verpe summitte, and also the lowest part of the height agree with the extreames of your shorter staffe. The space then betweene your first marked place and this latter, declareth the just heighte. Oftentimes the same impediments, ye shal not haue cause to goe so farre backe or forwarde, as the height cometh unto. This remedy is prouided. Spere the little staffe halfe his length, and so seeke it. Stations (as afoze) untill the extreame of the shorter staffe be found iustly to answere eyther end of the height. When the space betweene the two standinges must be doubled to haue the just height. Or if ye list, ye may moue the shorter, according to the fourth part of his length, or to any portion, as to the fift, six twenty &c then shal ye haue that part of the height betwene two stations.

A remedy
prouided
for want of
grounde

Yet know this (which experience by diligent practice will shewe) the bigger parties ye take, the lesse error ye commit. A little error often multiplied, encreaseth to a greater.

Now that al the aforespoken may the better bee perceiued, behold the ensample ensuing, as ye may see by figure declared in the which the height is imagined a. b. the first station c. the short staffe g. is measured from c. iust his length. I am forced to conclude, that the base of the height a. b. is from my standing c. euen his precise length. So then if ye measure that distance of a. c. being 13. paces, ye haue the true height of a. b. as many In the other standing place d. the shorter staffe is founde from c. twice his lengthe and a halfe, wherefore

The grōnde
of this maye
be gathered
of Euclide
in his per.
spectiue. 2.
Theo.

I muste affirme the heighte a. b. to be contained or founde in the distance a. d. twice and a halfe which length

a. d. is apparant 32. paces. All this is spe-

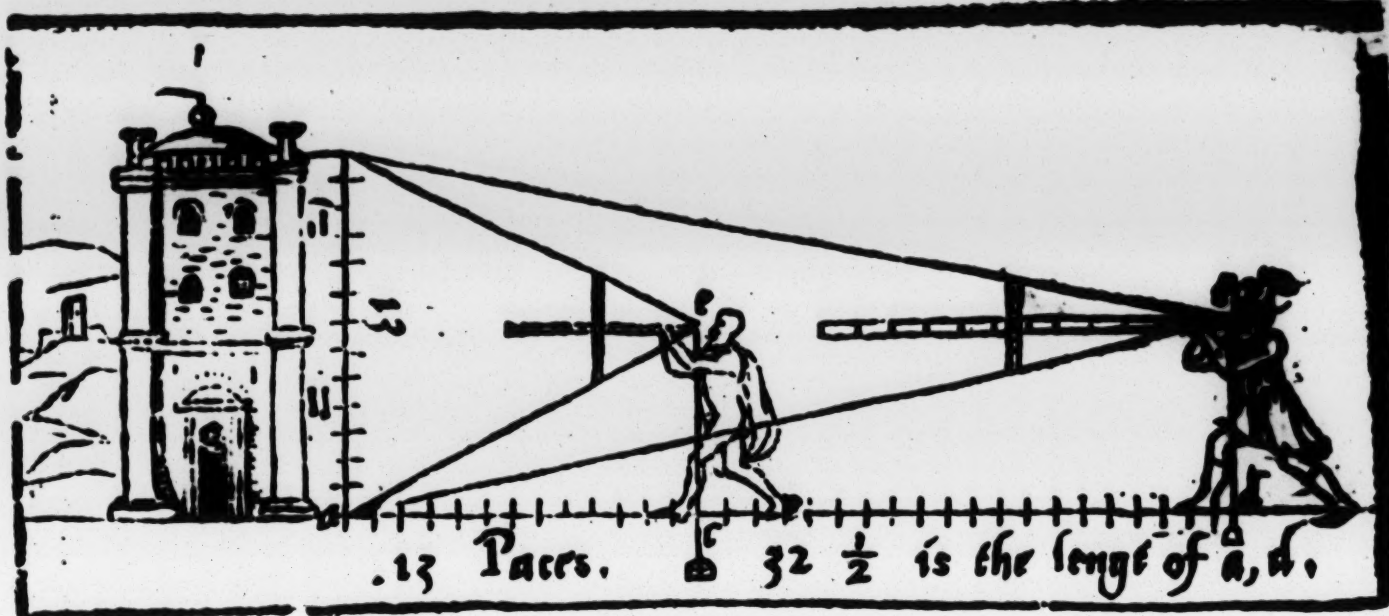
ken of the height, may wel be under-

stand of Latitudes or widenesses,

& Lengthes following.

How

The vse of the



Howe the breadth or wydenes of
things are founde, and by them, Length,
or any distaince at pleasure.

The iiiij. Chapter.



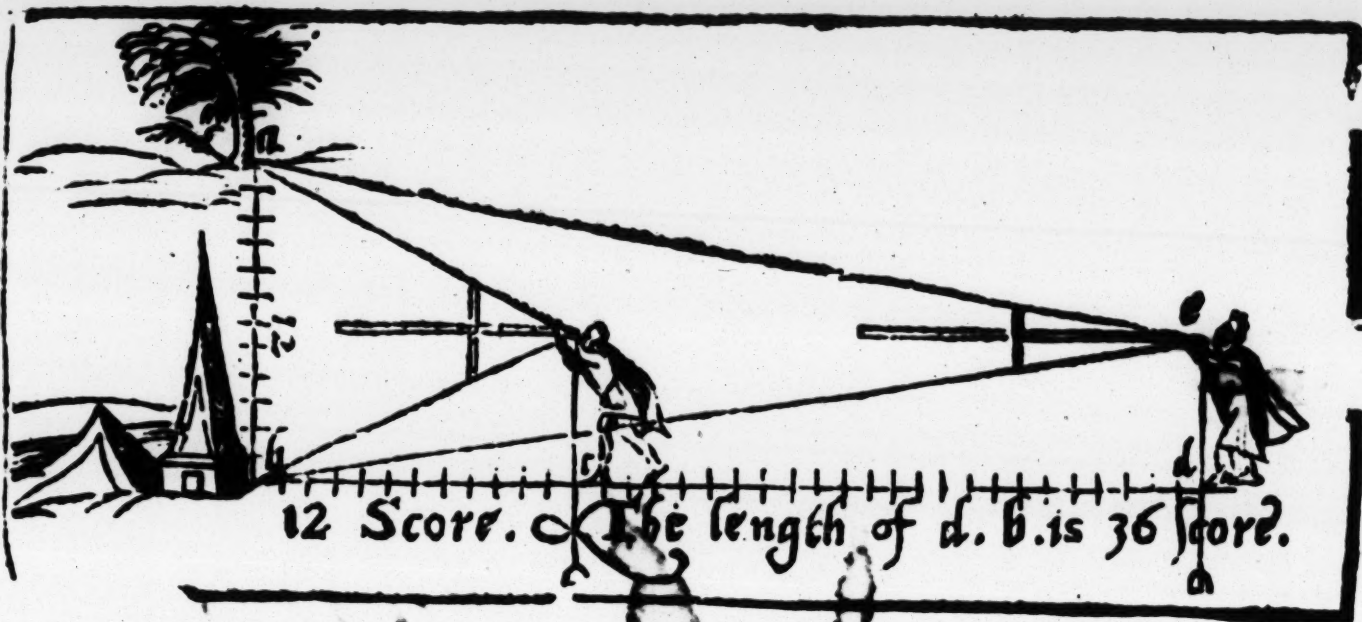
Whefore I have instructed afore of heights, the same un-
derstand here of wydenesse, leagthes. &c. For none other-
wise are Latitudes or wydenes searched by this Instru-
ment, then before is declared of heights, only this excep-
ted, that the short staffe must lye contrary, the ends accor-
ding to the breadth, being by the extreames of the short staffe, the very
bottommost parts or ends of the Latitude, noting your stations ryghte
with the middle of the foot. And so performe all, as before. And as
I sayde, thereof the parts of the Height found betwene your standings
even the same thyng is well vnder here, so all manner partes of the
breadth.

Ensample.

The breadth in this figure followinge is supposed a. b also the
first station c. the next d. Wherfore is to know the widenes
a. b. and the length or distance d. b. Marke howe the ends
of the lesser staffe are turned to the extreames of the widenes.
Then beholde howe the short staffe in c. is but once his length remo-
ued from c. Wherefore (by the instructions of heights afore) ye may
holde saye, that the wydenesse a. b. is but once contained betwene
d. and

And that measure is founde 12. scope, as much is the other a.b. In the
 Figure standing d. the little staffe is removed three times his lengthe
 from c. For that cause I conclude (and truste) from b. to that station
 three times the breadth, which breadth is 12. scope. And by the rule
 I have founde the Length of b. d. 36 scope, my desire. Thus are
 Latitudes founde and by them Lengthes. &c.

Beholde the Figure.



Whensoeuer any distance is put, whose certaine length ye require:
 measure (by the art expressed) either the height of any thing there stande
 or the breadth, and see howe oftentimes that widthnes or Lengthe is
 contained into your standynge: which knowne, the length cannot bee
 hidde, as is declared.

Now in fewe wordes to conclude, ye may by this Instrument A more large
 measure the distance of houses, Steeples, Trees, the length of ger vsc of
 Walles, the breadth of Ditches, Images in height, and such this Instru-
 lyke. The good wicke Carpenter standynge in a place where hee maye ment.
 playnely see a whole house, or any manner frame, with greete pleasure
 may by this gette speedely the true proportion of that house, which hee
 ought to note in a Table, and when tyme cometh (not withoute his
 great payse) may make, reare, and set by the lyke. This I take to bee
 sufficient for these Craftesmen.

I have before forgotten to admonishe you whensoeuer ye lyfte to
 measure anye Lande exactly, by the Instrumente Geometrical na-
 med the profitable Staffe: to set vpryghte a Rodde, the lengthe of
 a perch. Or if the distance be longe, to passe oute, or rather in-
 ly great

Howe the
 length of
 land is ex-
 actly found.

The vse of the

Ipe muste true as the pearches at the end of your length, the
extremities muste with such little matters (when you from them and
stretch the lengths by that certain measure, as is written: so shall ye
not faile to bring very true Lines. Note that a little errorre founde
in the breadth, oft multiplied, succedeth to a great, yea to an intolerable
fault in the length, therefore the breadth of timber ought cruple
to be searched. This I take sufficient for these craftsmen.

I would desire to here my graue mislikes seeme to be obscure that I
were present the instructour: for truly a lively hope of a more
speculate, somewhat perfecter, furthwith truer hope
in my iudgement, then the first matter. Farewell.

Accept my good will, and looke the type
(if God spare life) for a profitable
currente of these
matters.

Francis Bacon

